US009434015B2

(12) **United States Patent**
Moreno et al.

(10) **Patent No.: US 9,434,015 B2**
(45) **Date of Patent: Sep. 6, 2016**

(54) **SAW ASSEMBLY WITH BEVEL GEAR DRIVETRAIN**

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(72) Inventors: **Jaime Moreno**, Arlington Heights, IL (US); **Kevin Wasielewski**, Downers Grove, IL (US); **Arturo Castro**, Mexicali (MX); **Philip Branker**, Elgin, IL (US)

(73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 233 days.

(21) Appl. No.: **14/242,147**

(22) Filed: **Apr. 1, 2014**

(65) **Prior Publication Data**

US 2014/0208600 A1 Jul. 31, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/250,917, filed on Sep. 30, 2011, now Pat. No. 8,857,067.

(51) **Int. Cl.**
B23D 47/12 (2006.01)
B23D 45/16 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B23D 47/12*** (2013.01); ***B23Q 5/027*** (2013.01); ***B23Q 9/0028*** (2013.01); ***B25F 5/001*** (2013.01); ***B25F 5/006*** (2013.01); ***B25F 5/021*** (2013.01); ***B27B 9/04*** (2013.01)

(58) **Field of Classification Search**
CPC B27B 9/04; B25F 5/001; B25F 5/006; B25F 5/021; B23D 47/12; B23D 45/16
See application file for complete search history.

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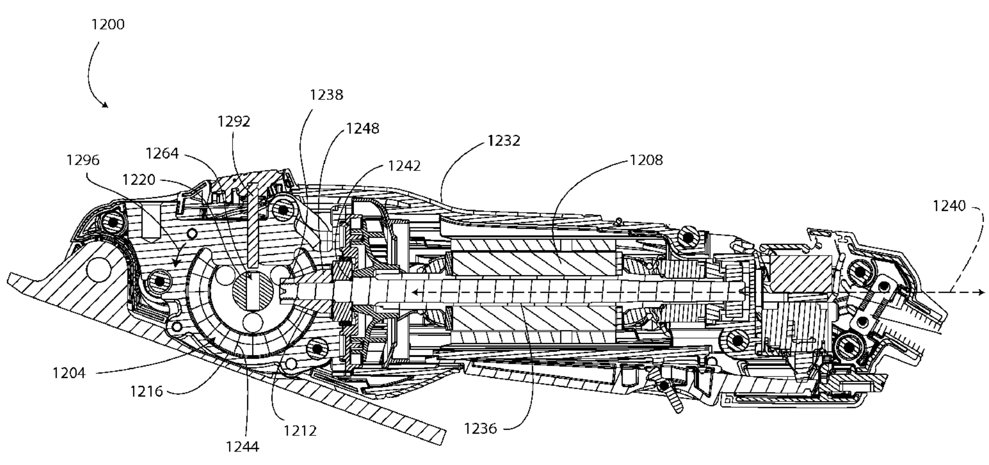
Primary Examiner — Hwei C Payer
(74) *Attorney, Agent, or Firm* — Maginot Moore & Beck LLP

(57) **ABSTRACT**

A saw assembly including a housing, a motor, a first bevel gear, and a second bevel gear. The motor is located in the housing and includes a motor shaft configured for rotation relative to the housing. The first bevel gear is operably connected to the motor shaft for rotation with the motor shaft. The second bevel gear is operably engaged with the first bevel gear, such that rotation of the first bevel gear causes rotation of the second bevel gear. The arbor assembly is operably connected to the second bevel gear. The arbor assembly is accessible for mounting an accessory thereto from an accessory side of the housing. The arbor assembly defines a first axis of rotation. The first bevel gear is located between the second bevel gear and the accessory side of the housing along the first axis of rotation.

15 Claims, 55 Drawing Sheets



(51) **Int. Cl.**

B25F 5/02	(2006.01)
B23Q 5/027	(2006.01)
B23Q 9/00	(2006.01)
B27B 9/04	(2006.01)
B25F 5/00	(2006.01)

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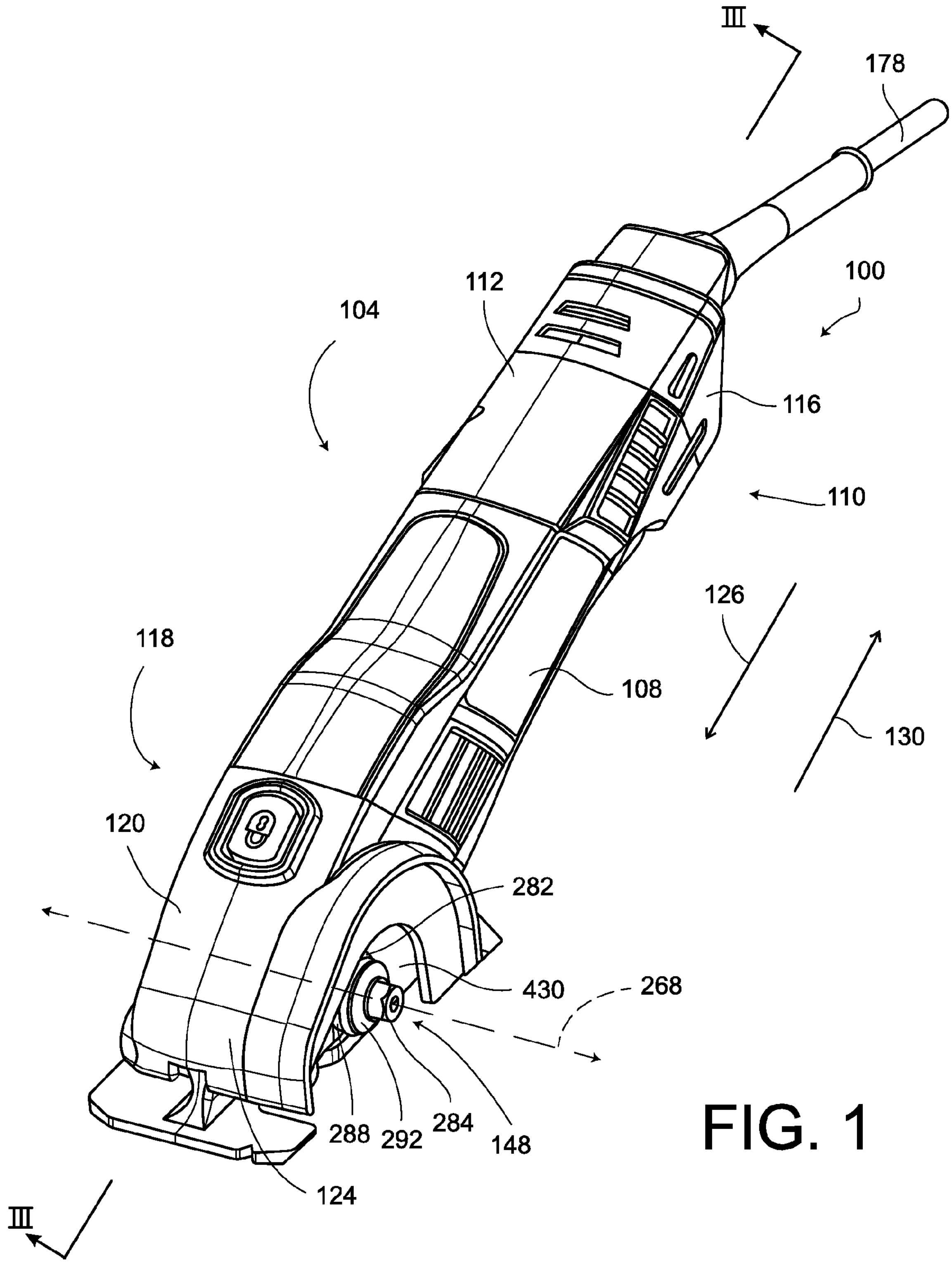
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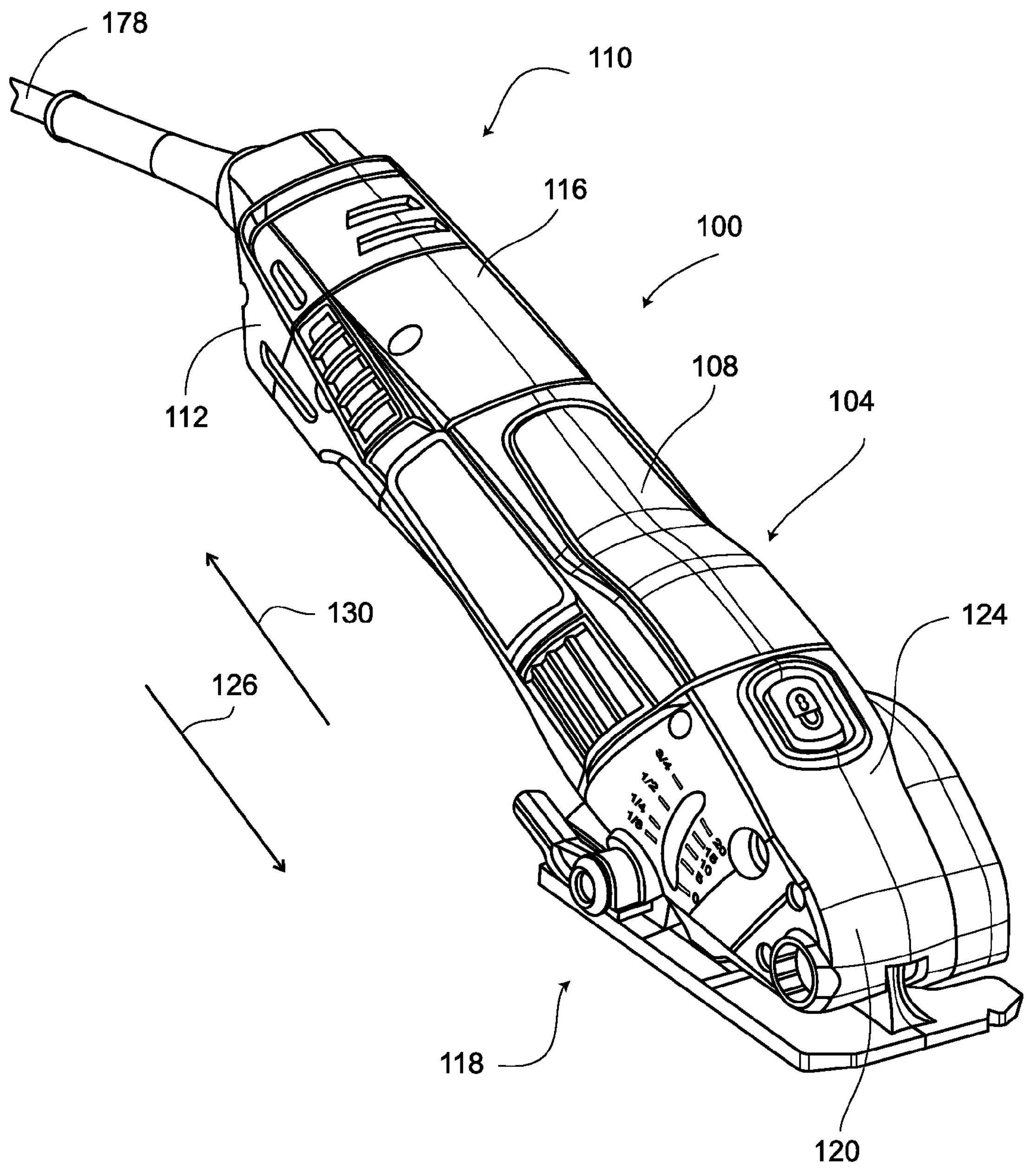
FIG. 1



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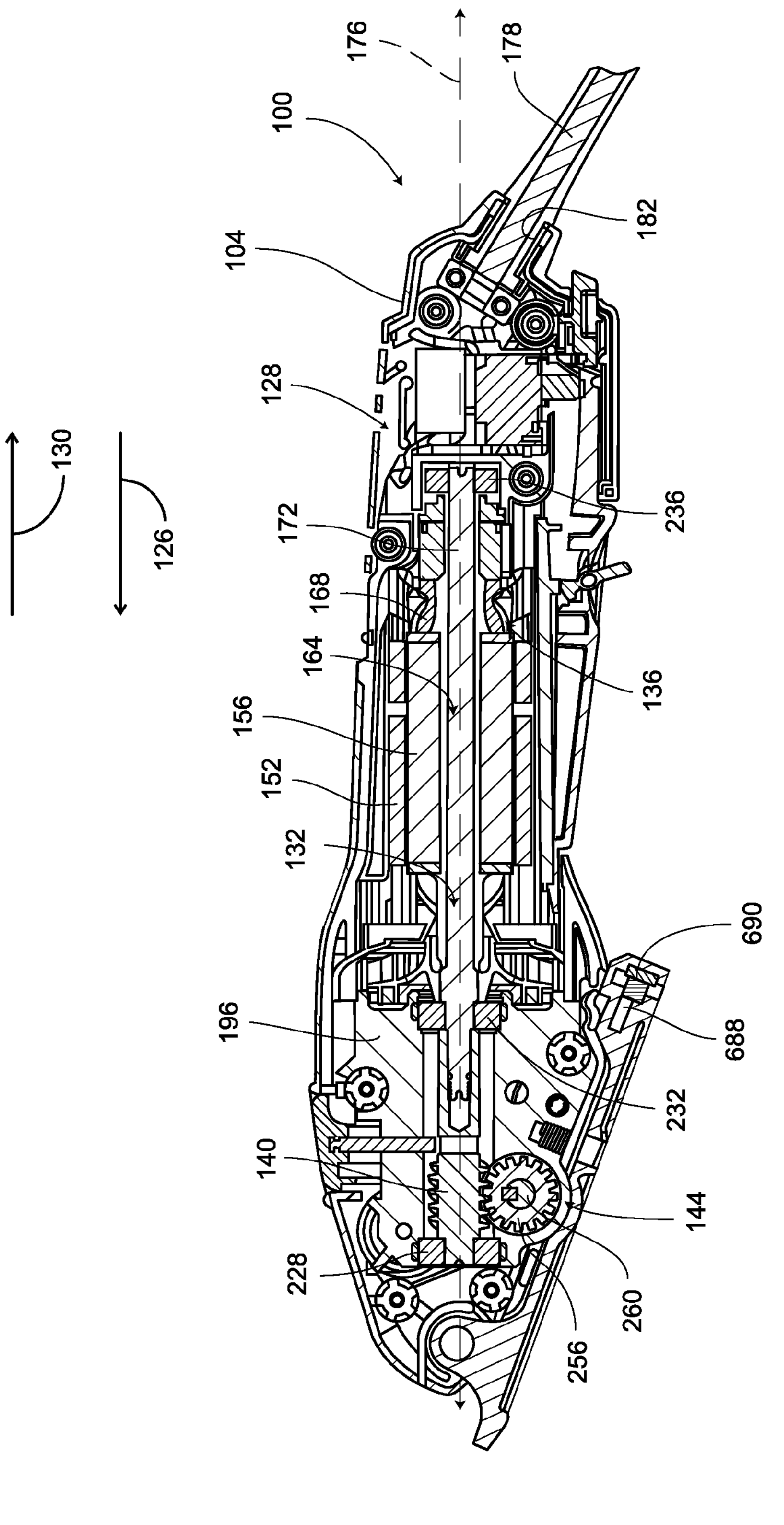
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FIG. 3

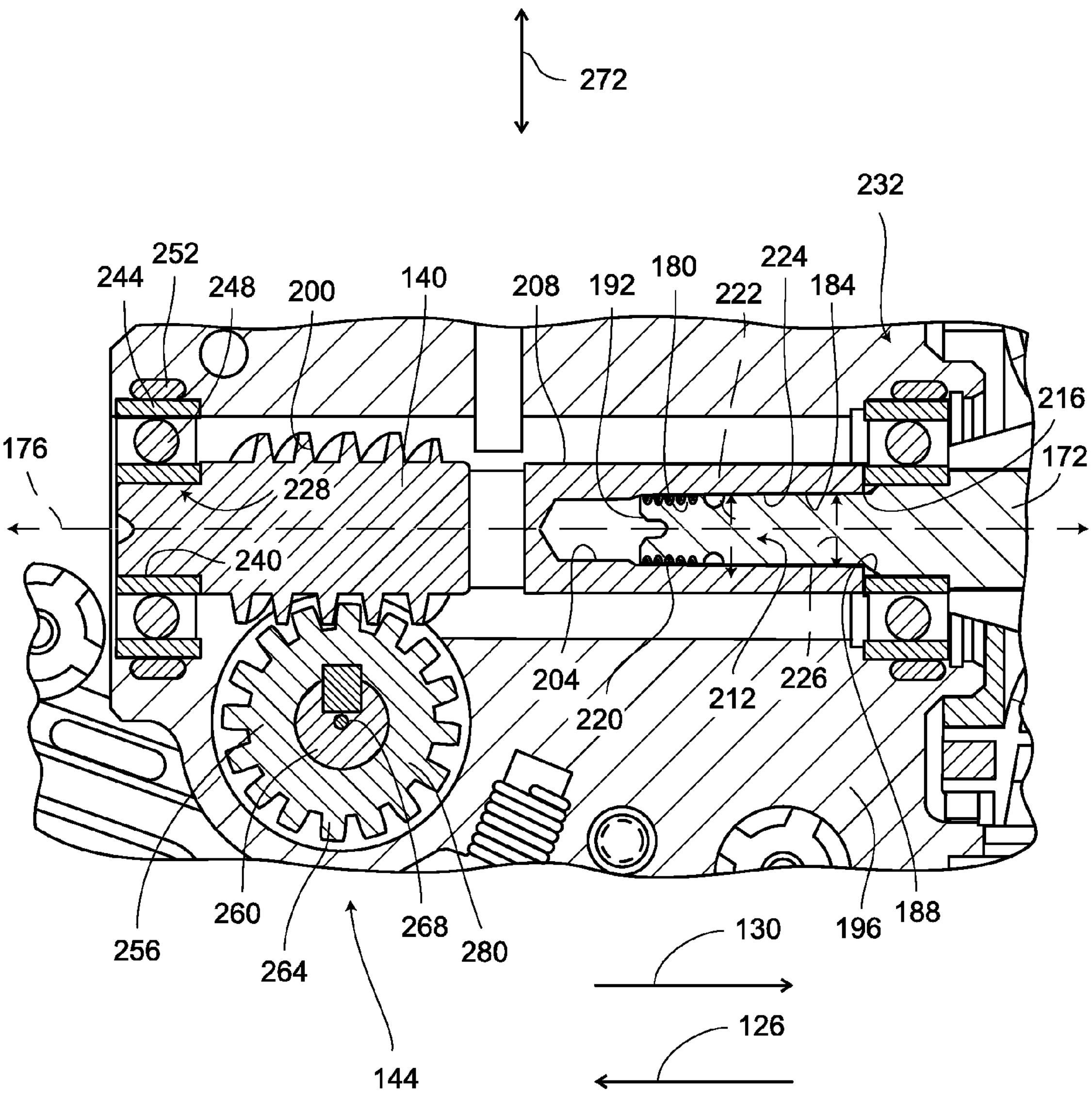

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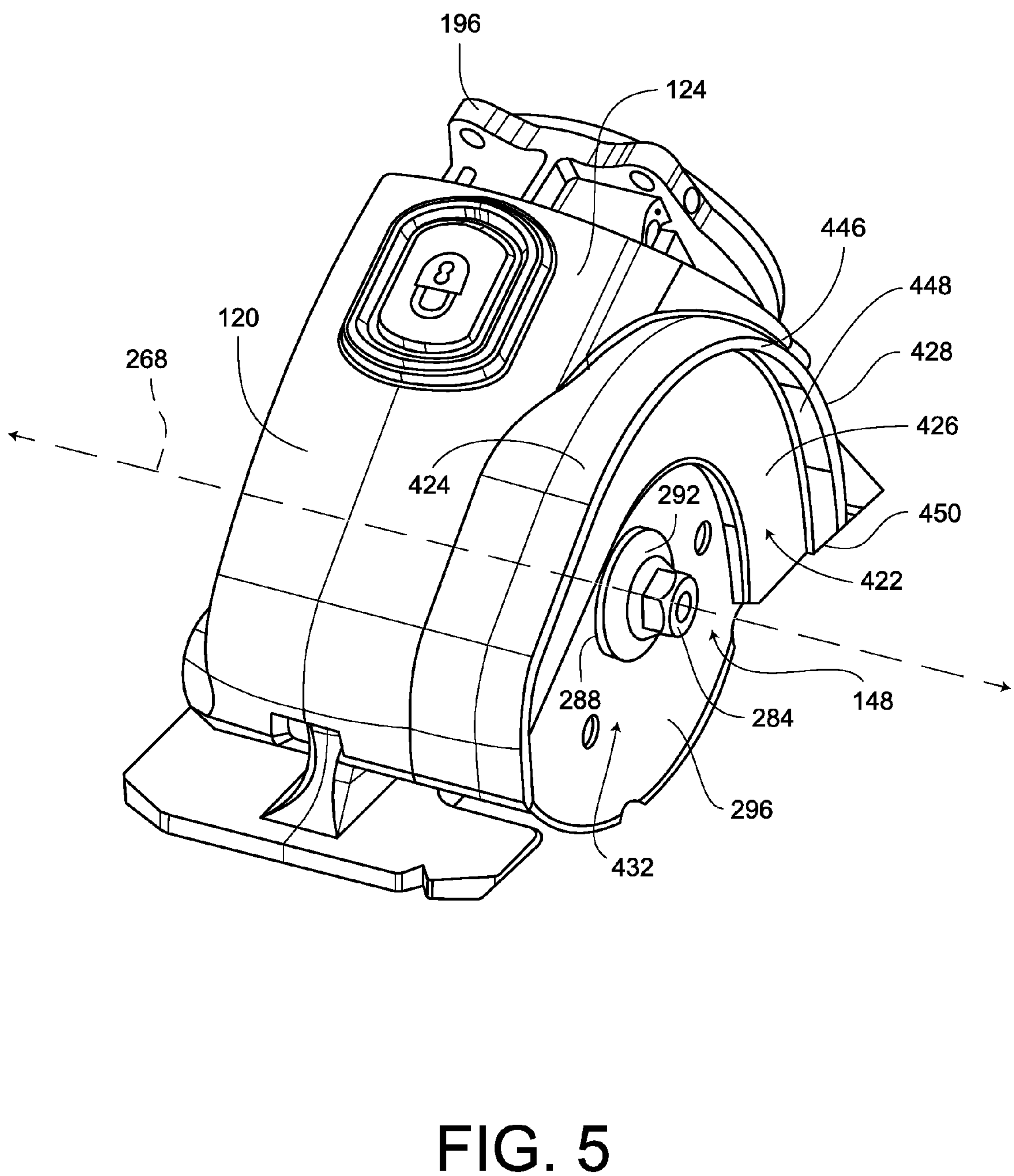
FIG. 4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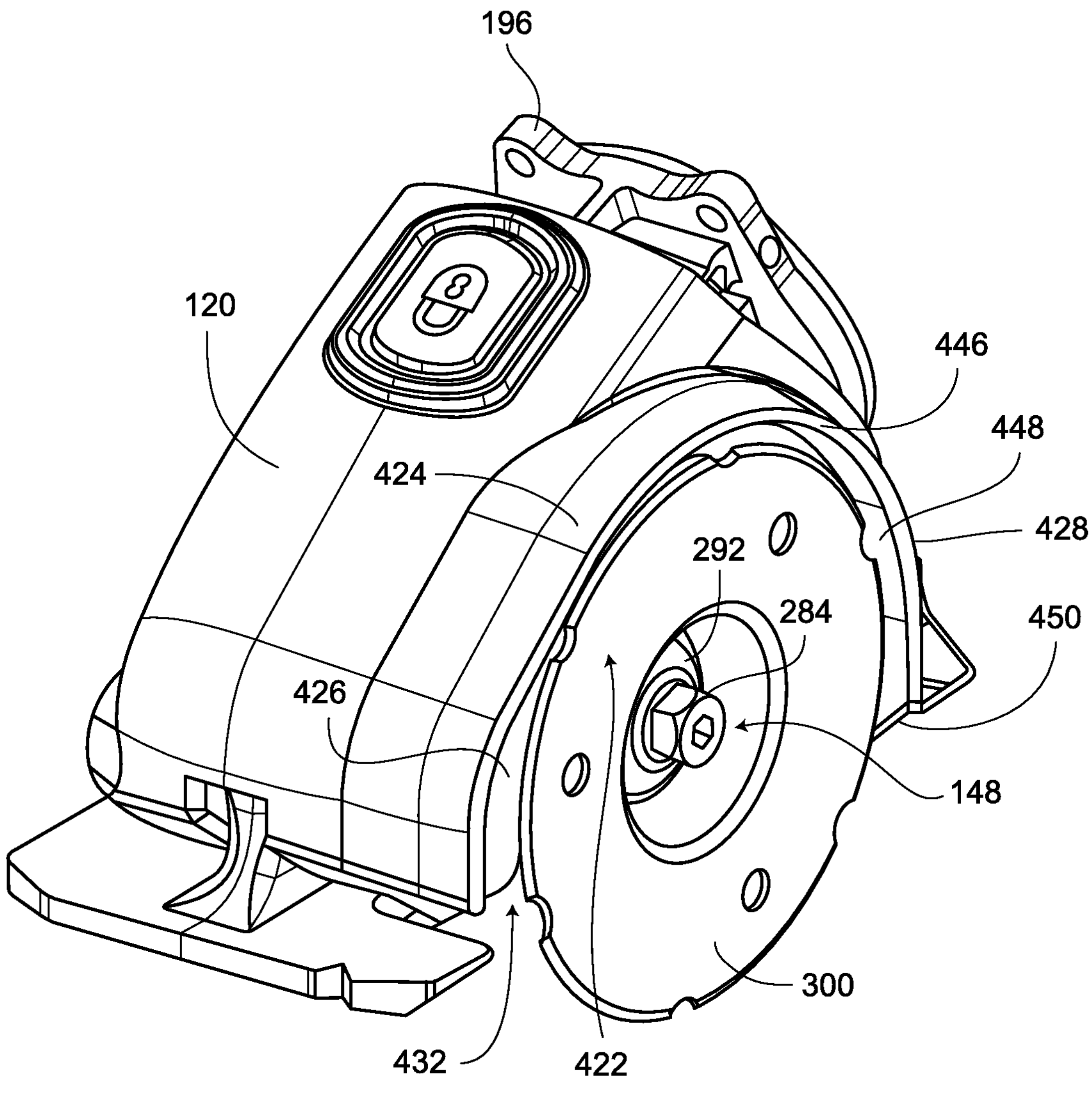

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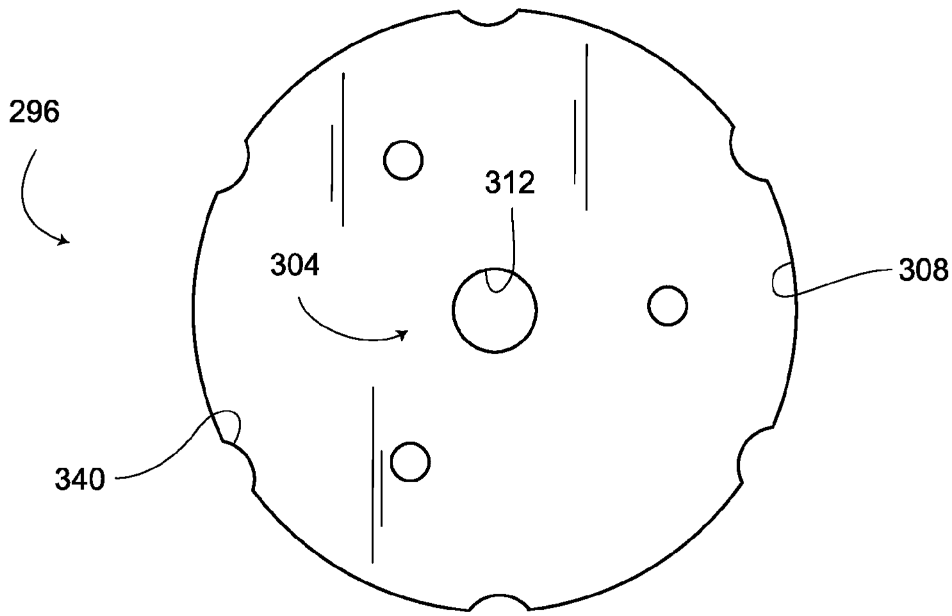

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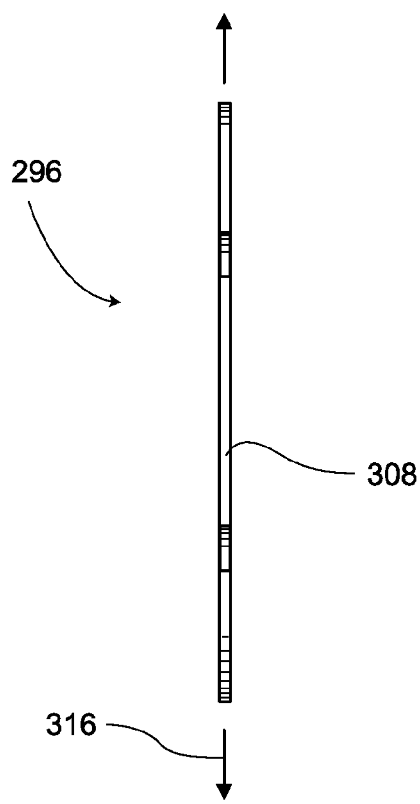

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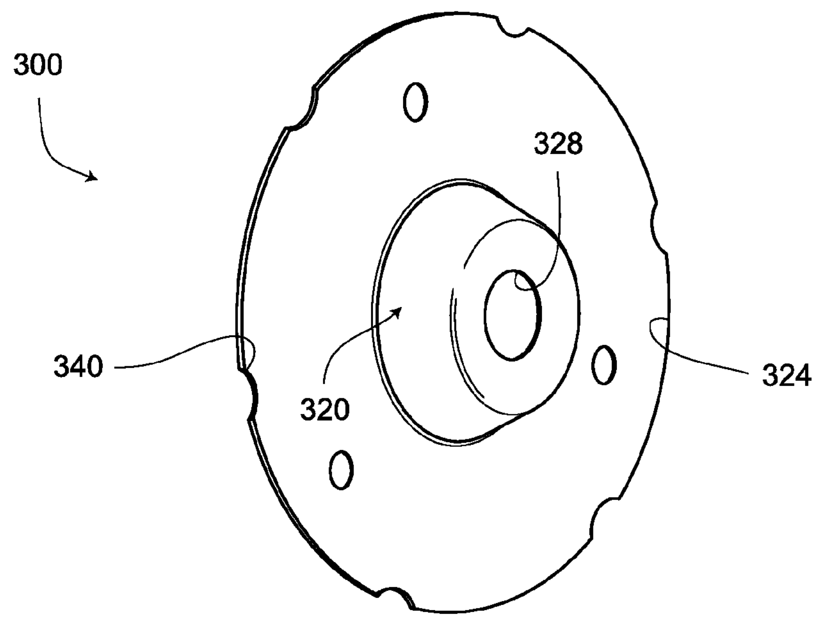

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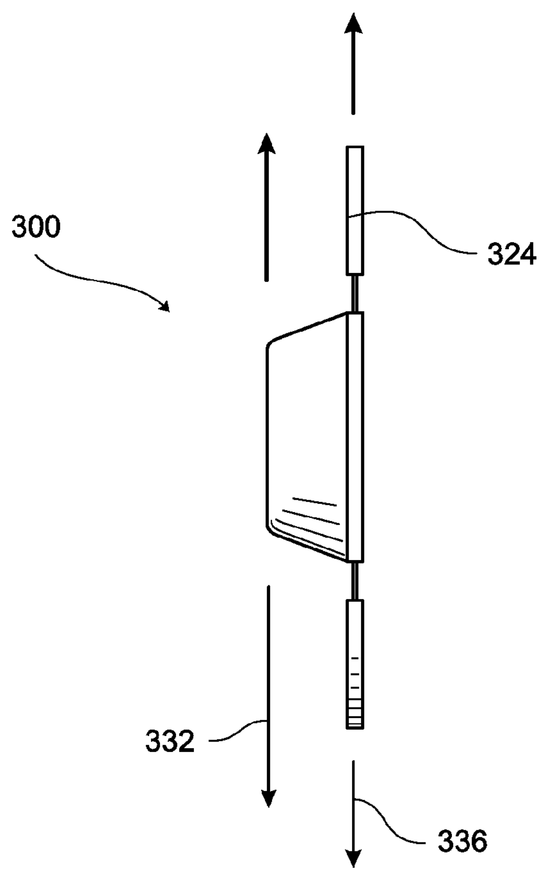

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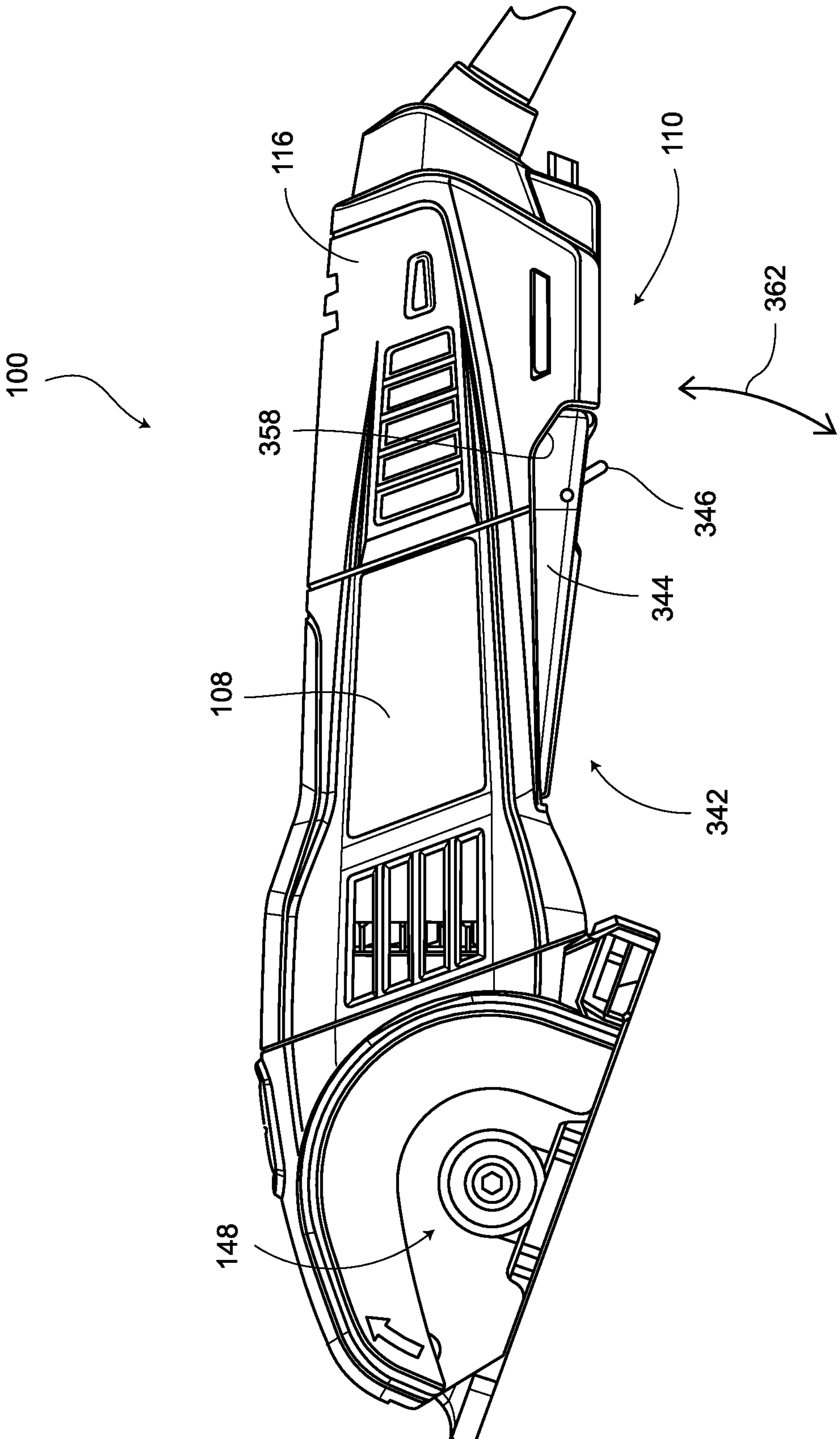

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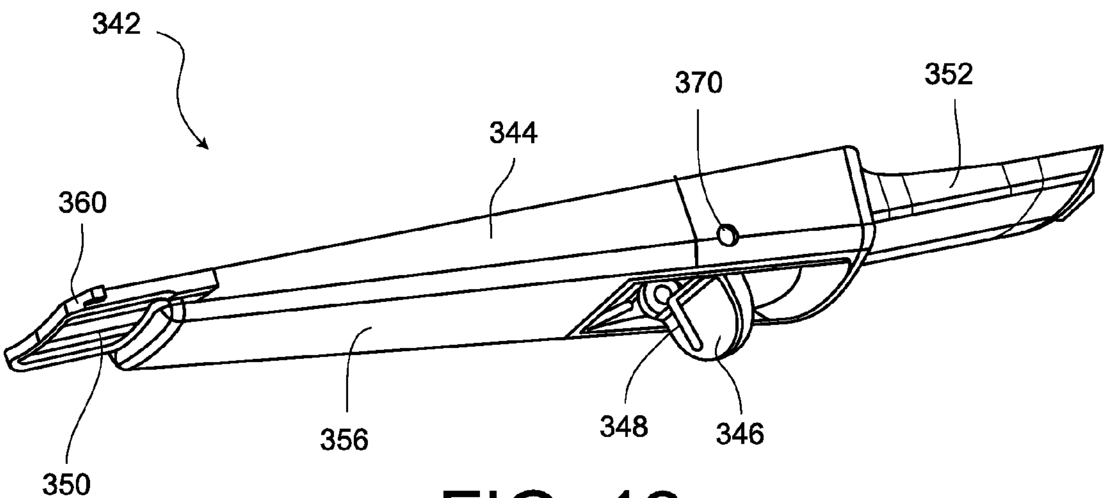
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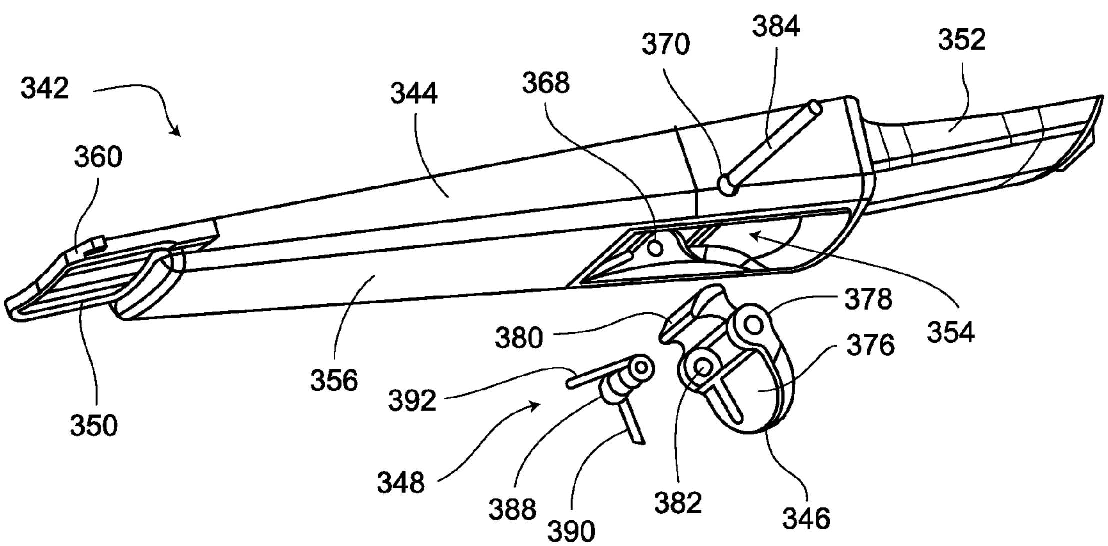
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FIG. 13

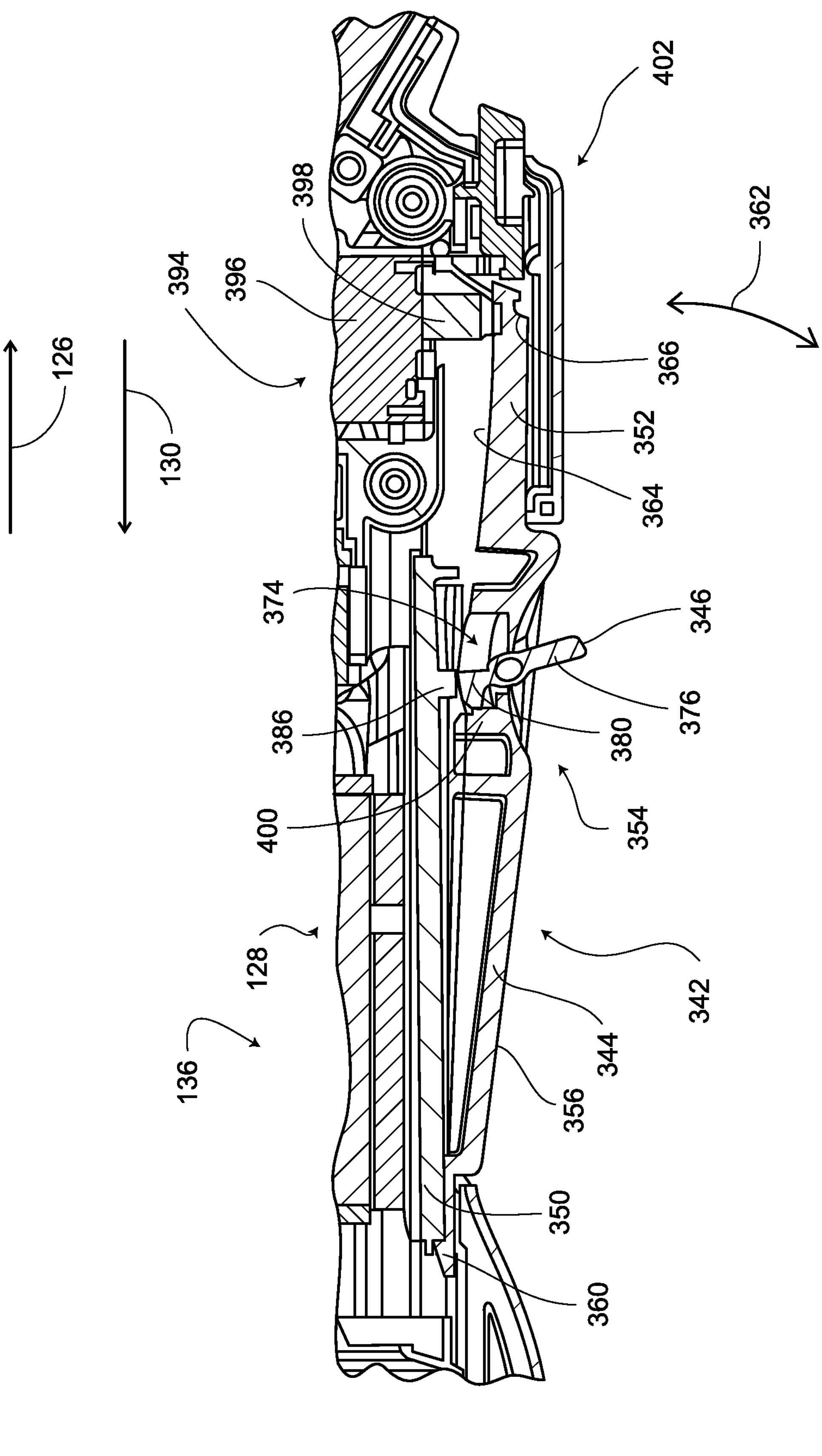
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FIG. 14

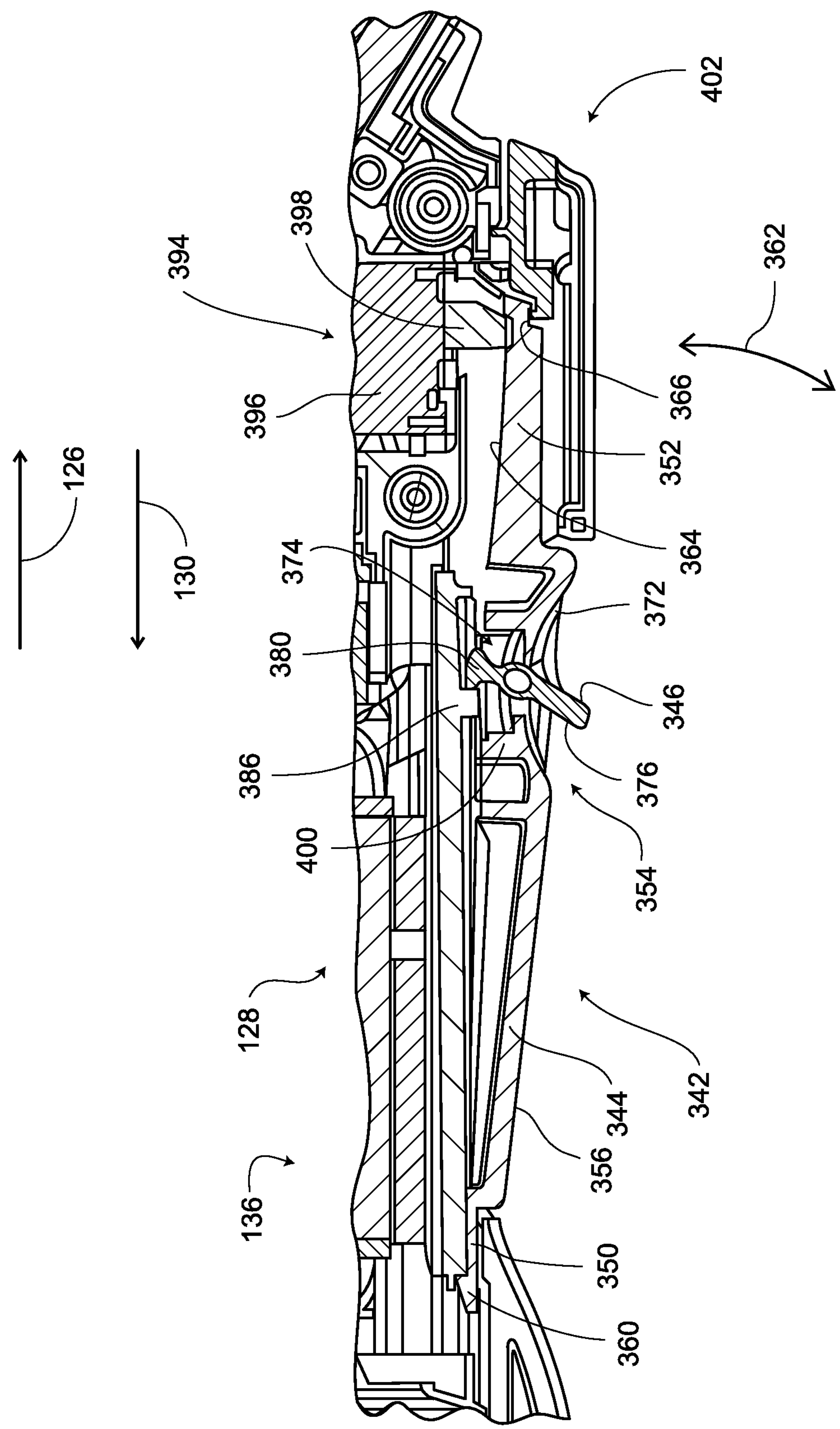
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FIG. 15

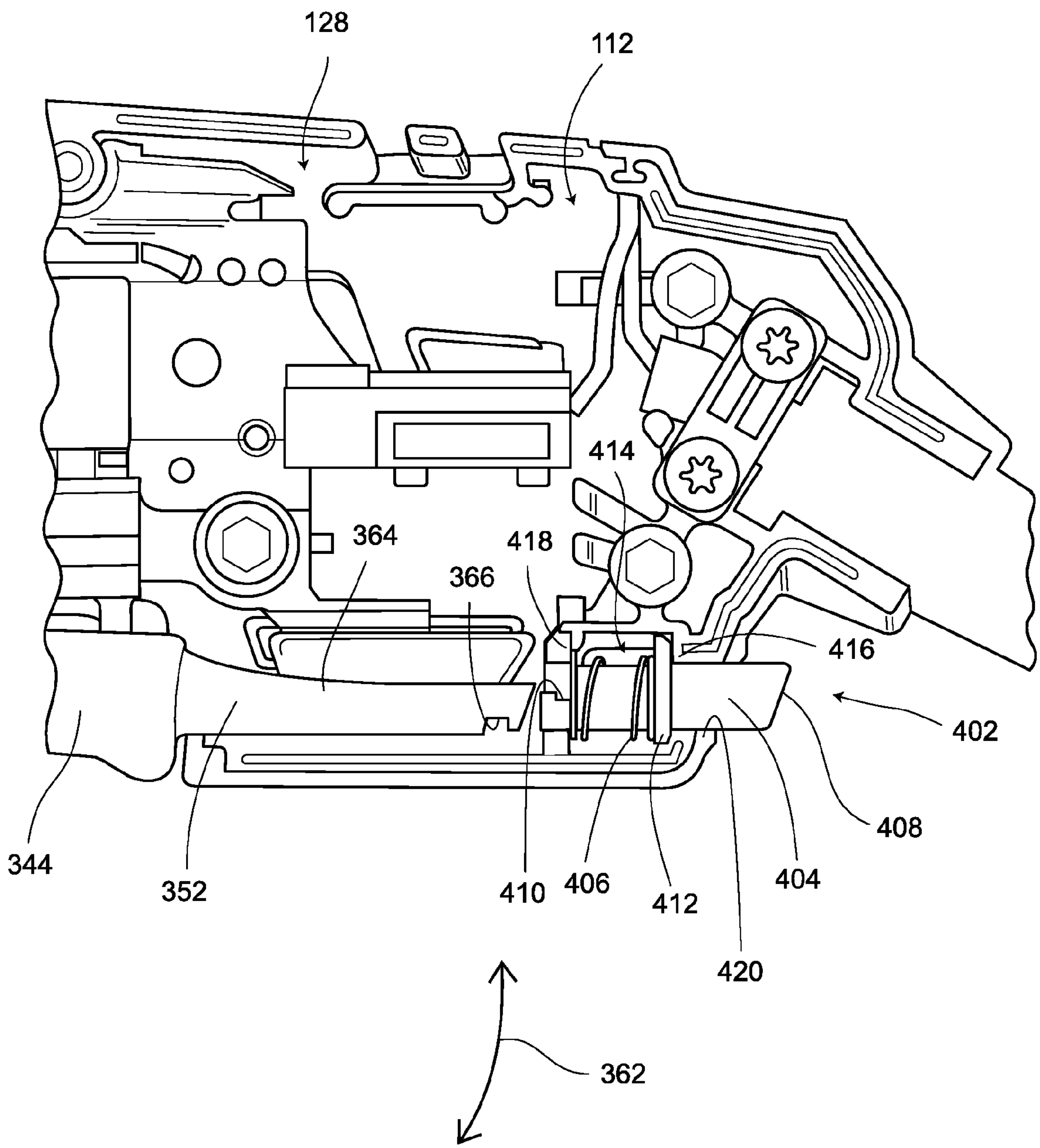
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FIG. 16

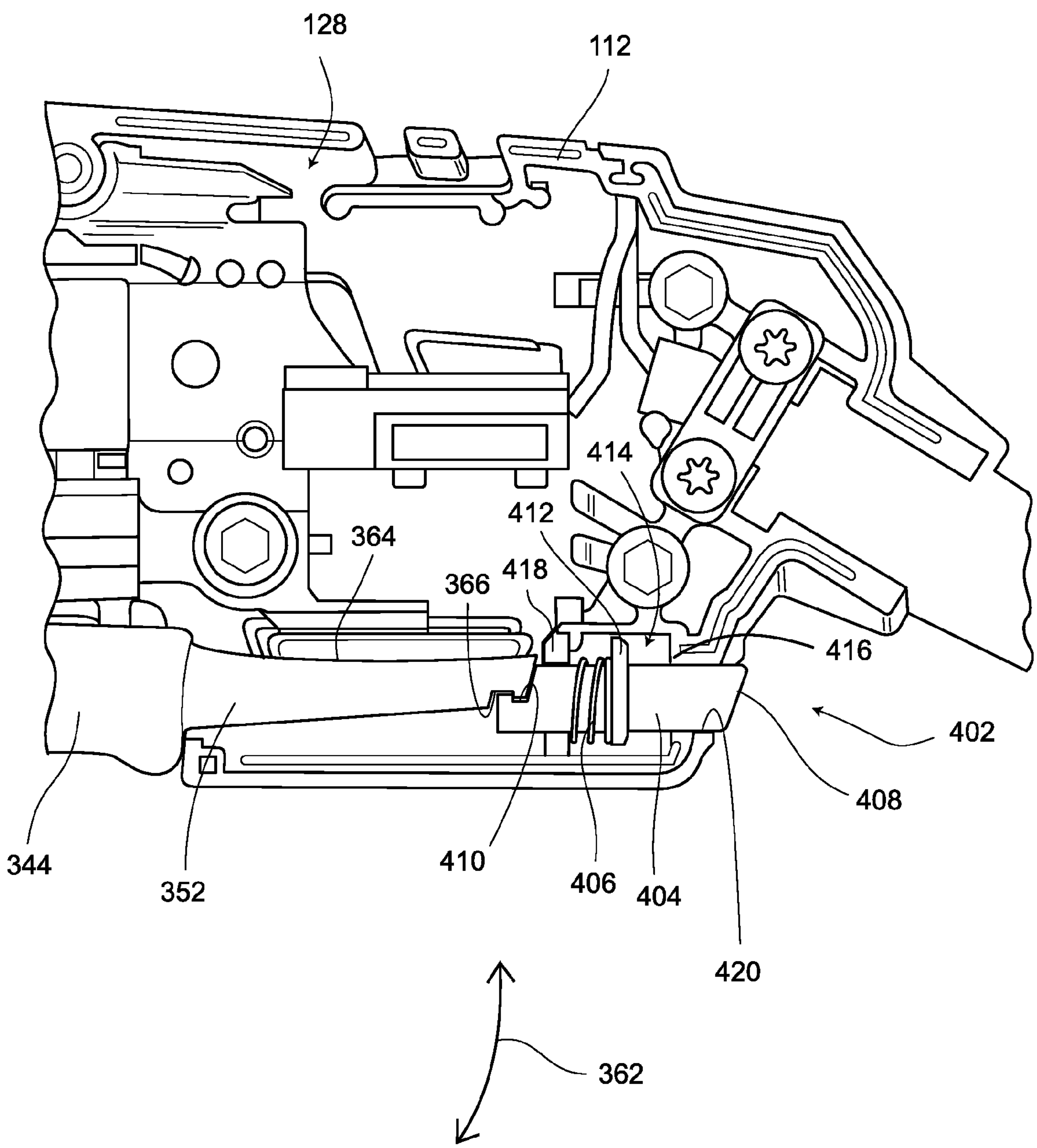
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FIG. 17

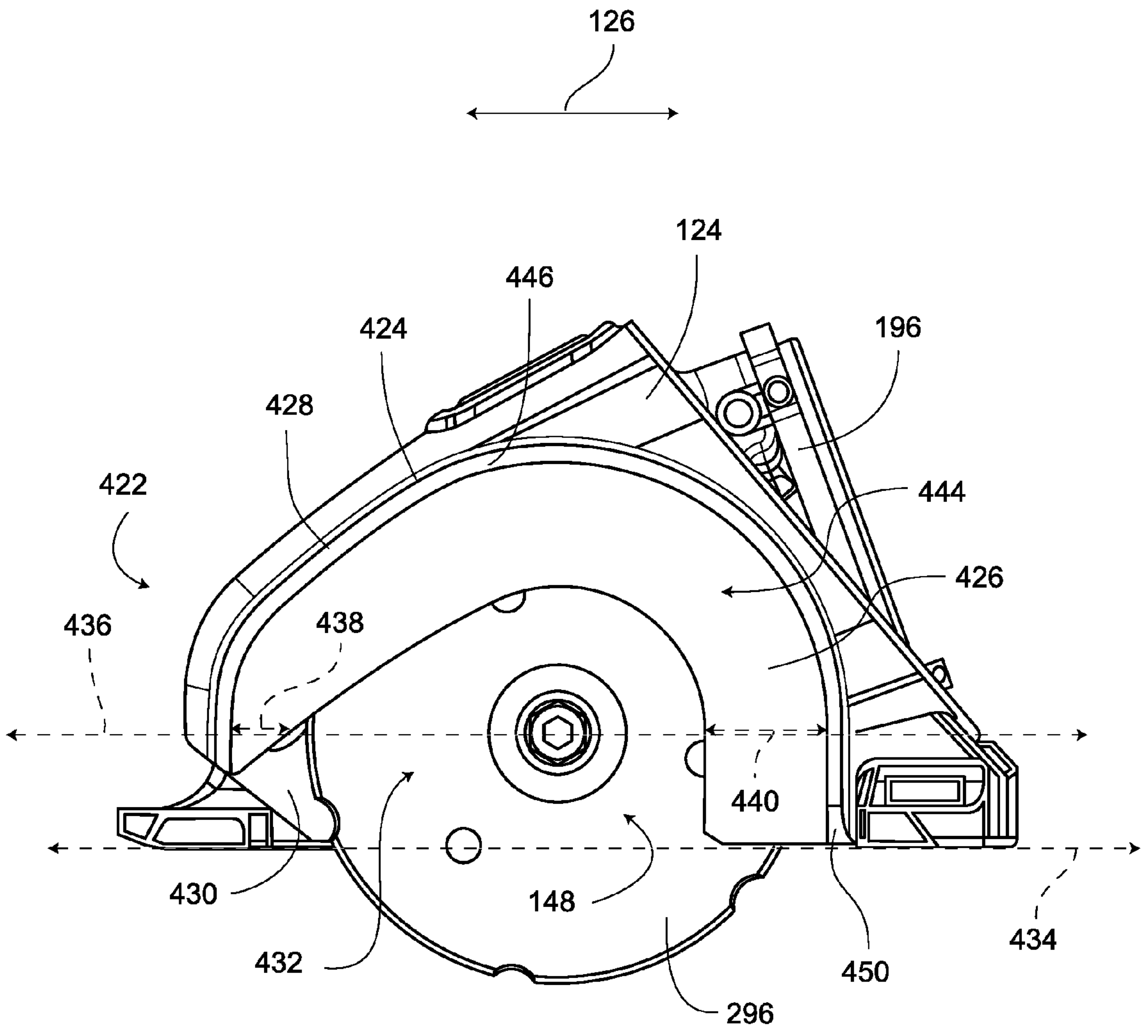
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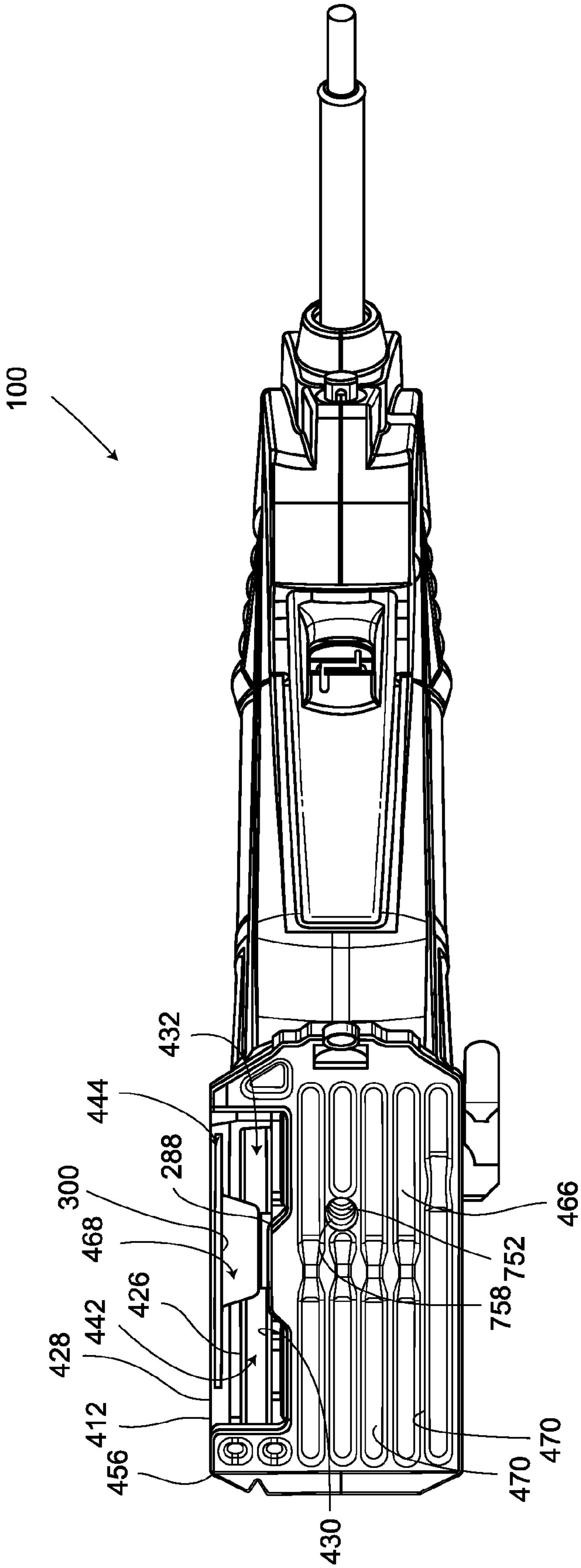
FIG. 18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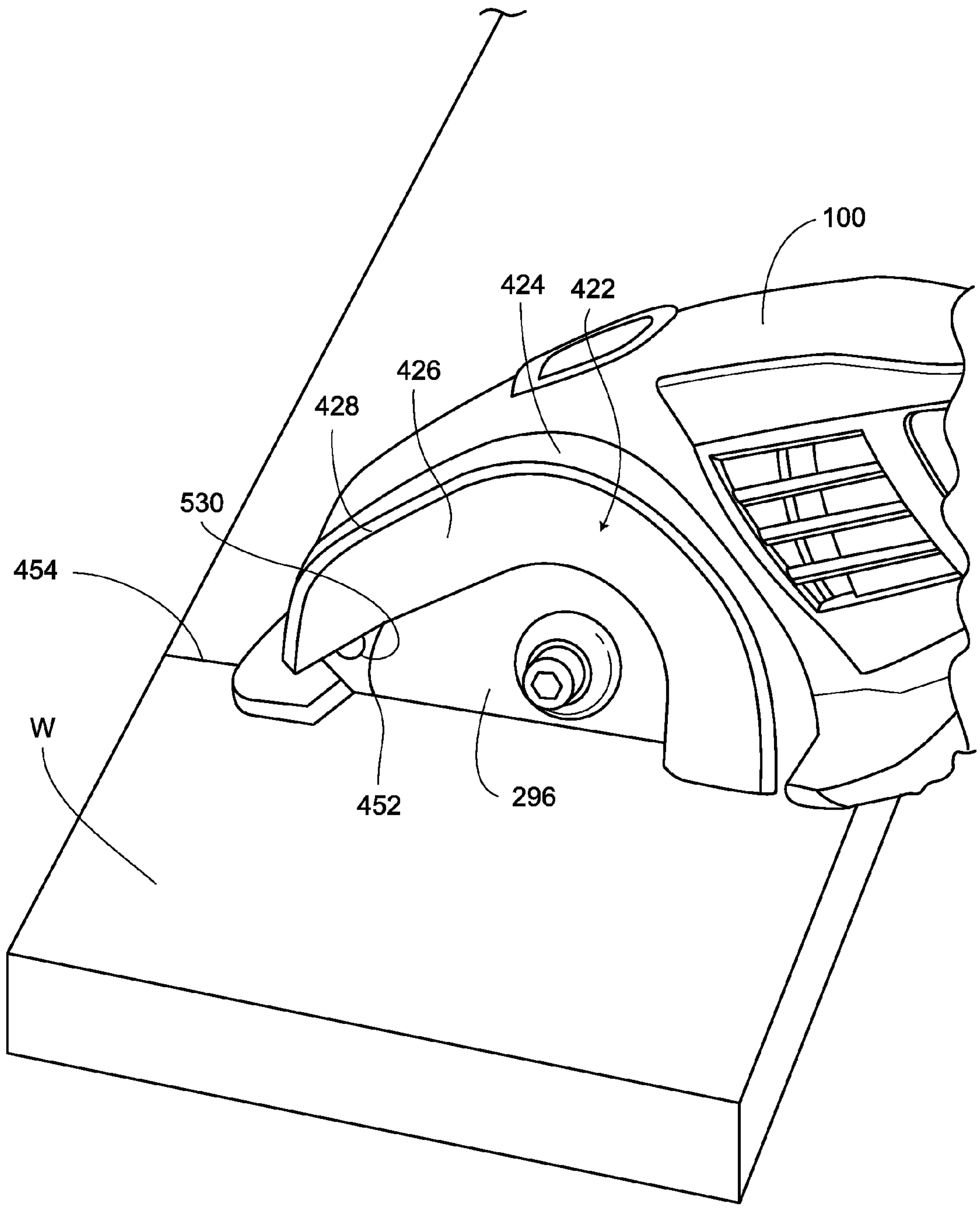

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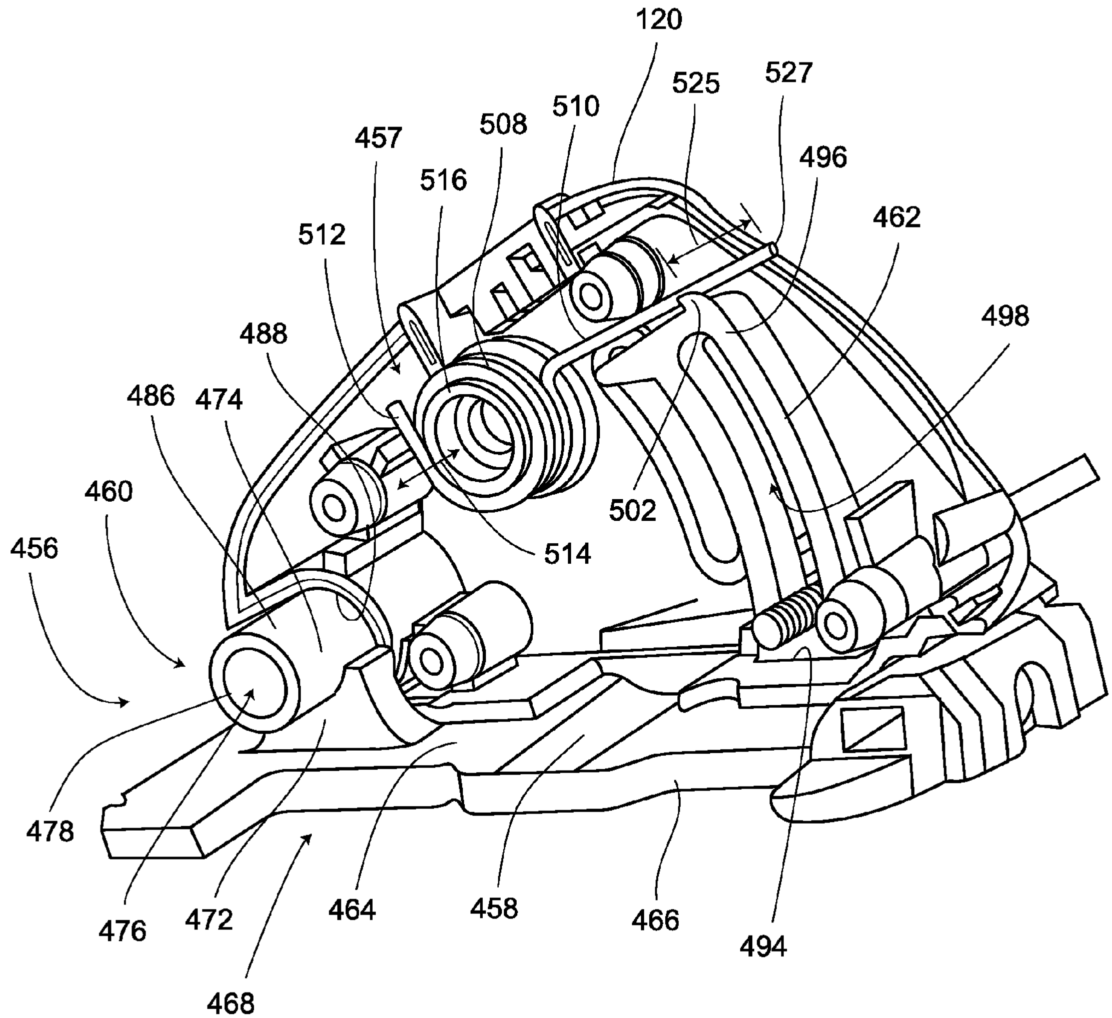
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FIG. 21

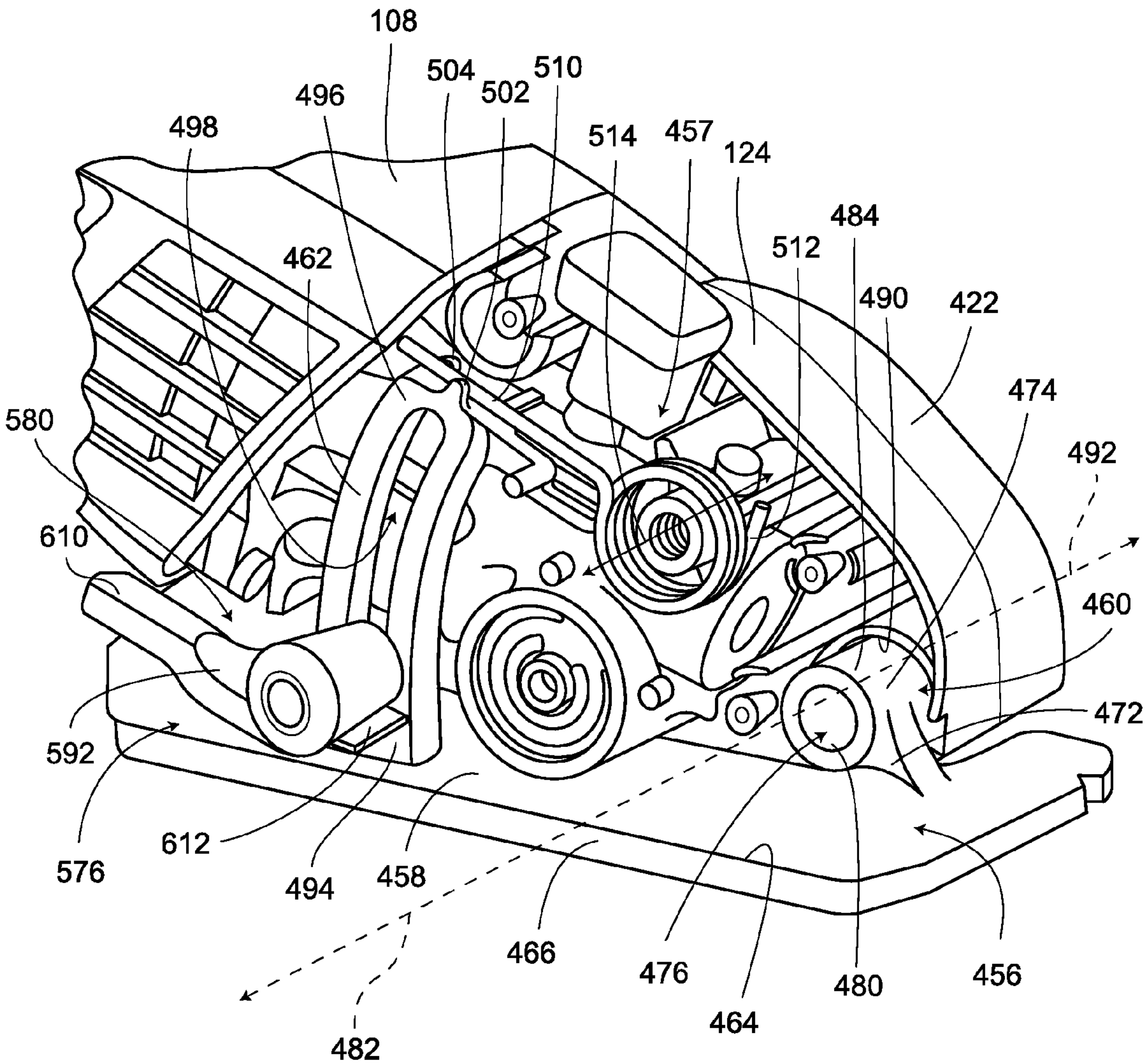
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FIG. 22

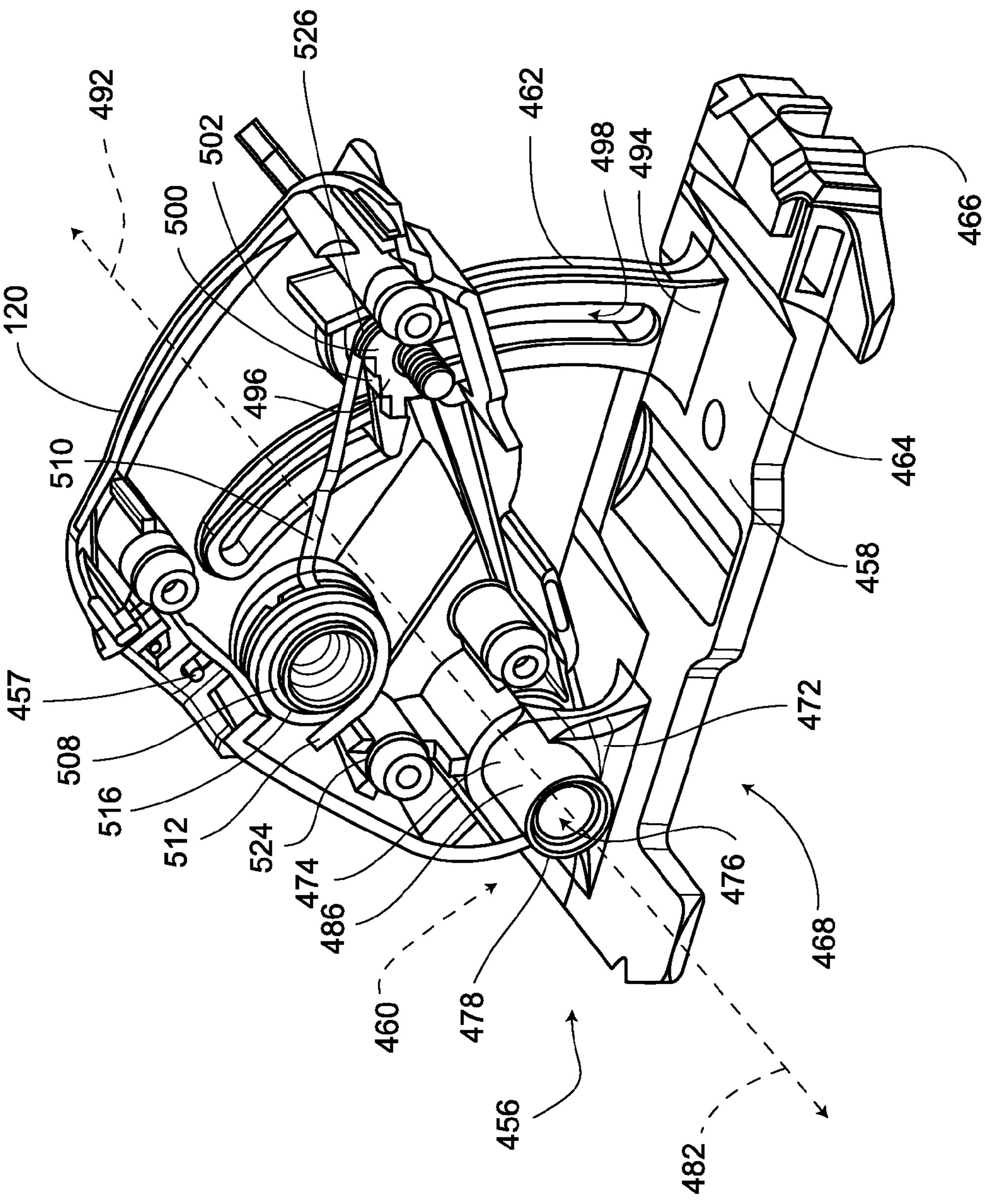
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FIG. 23

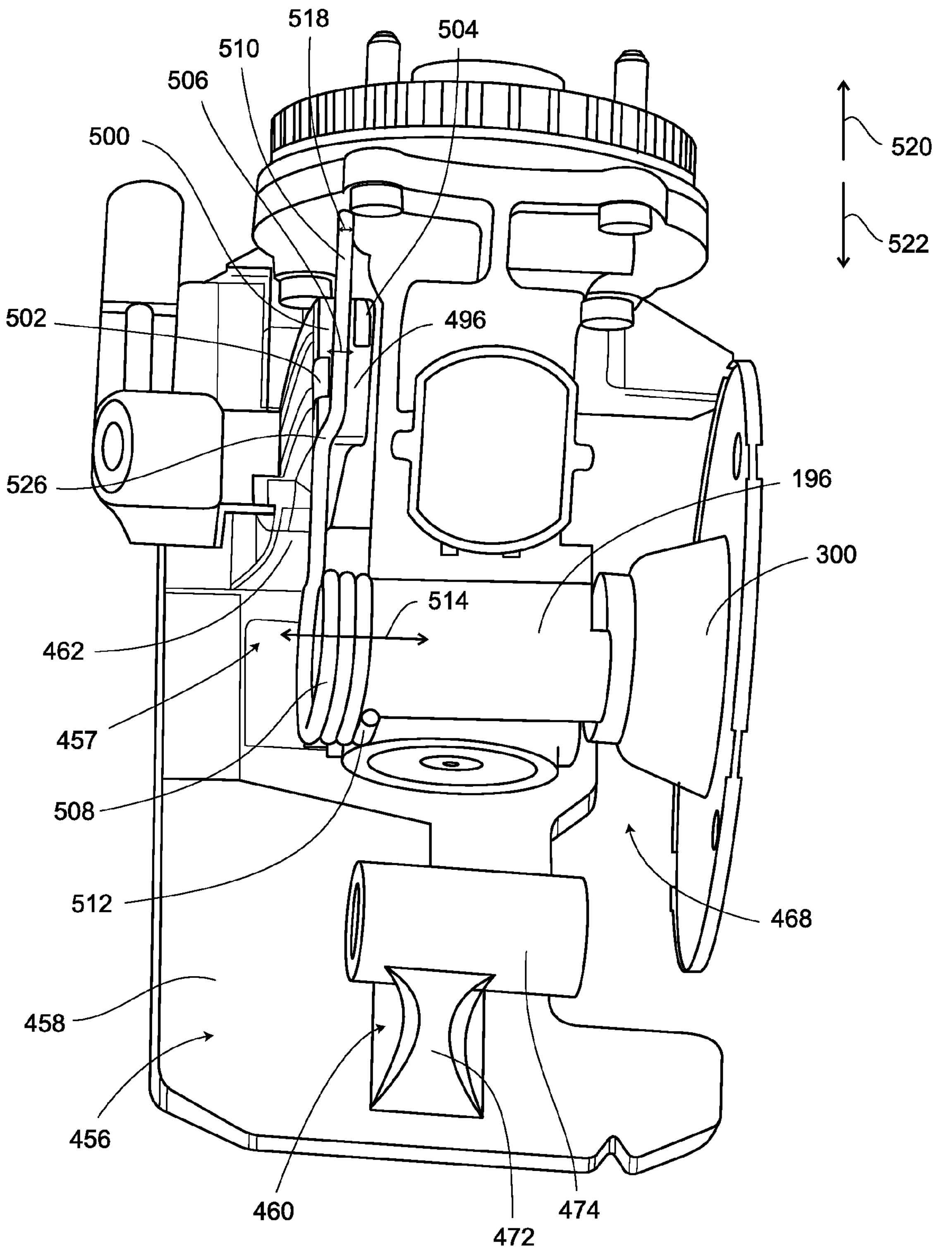
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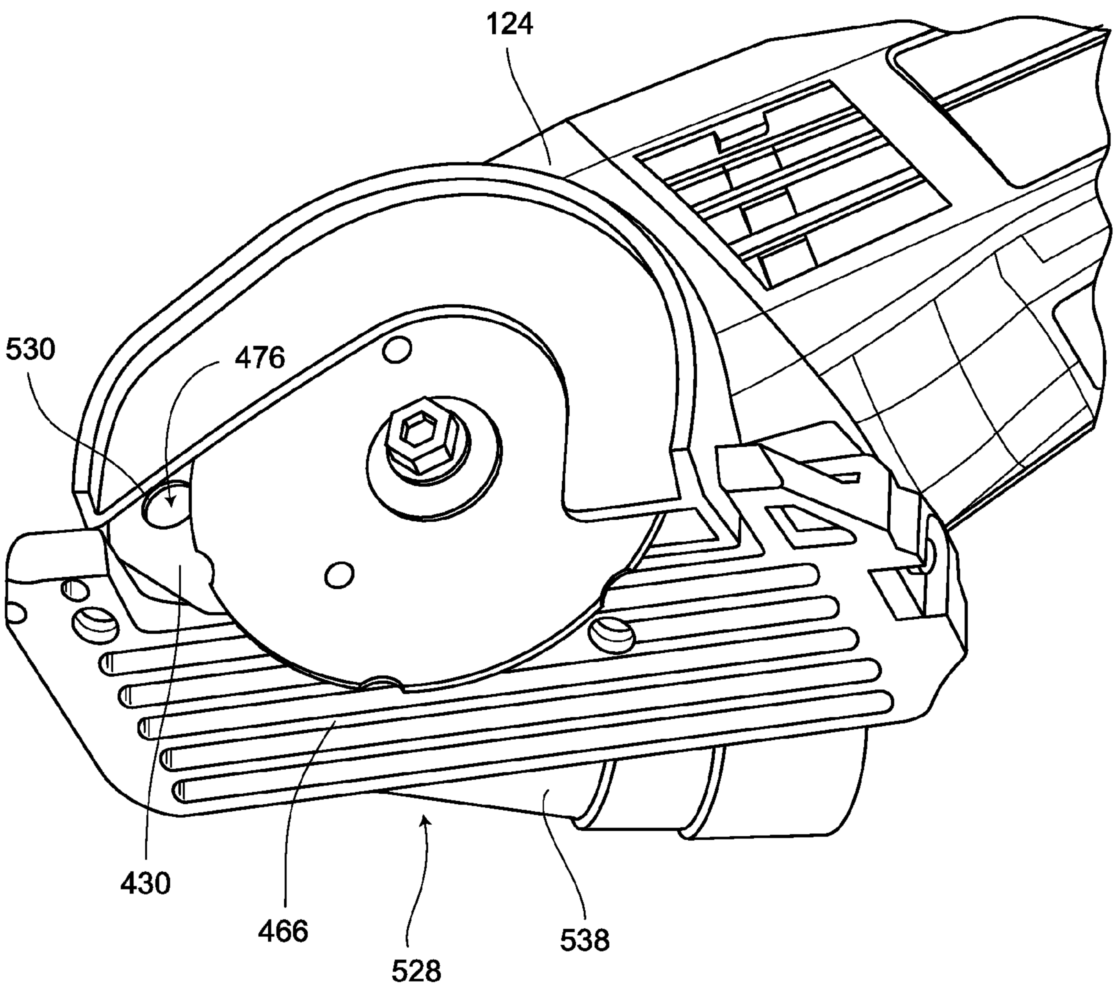
FIG. 24



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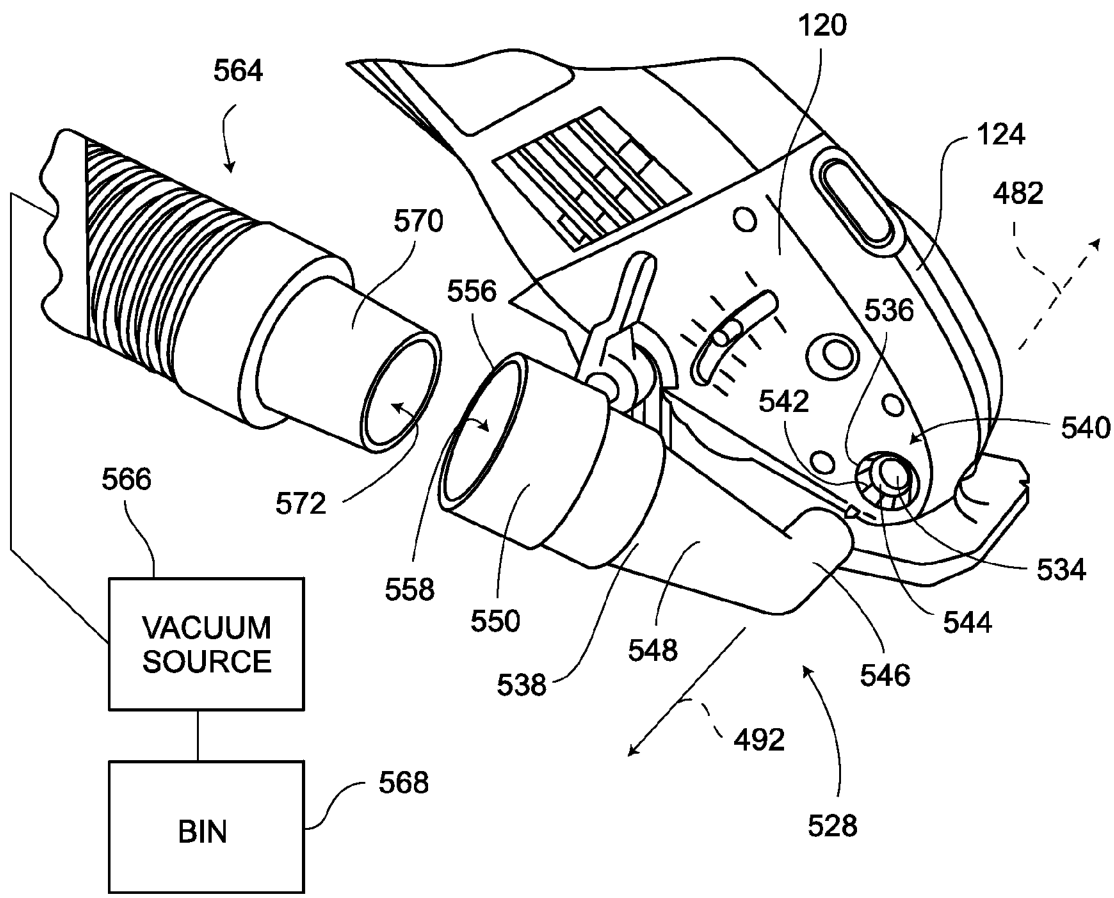
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FIG. 26

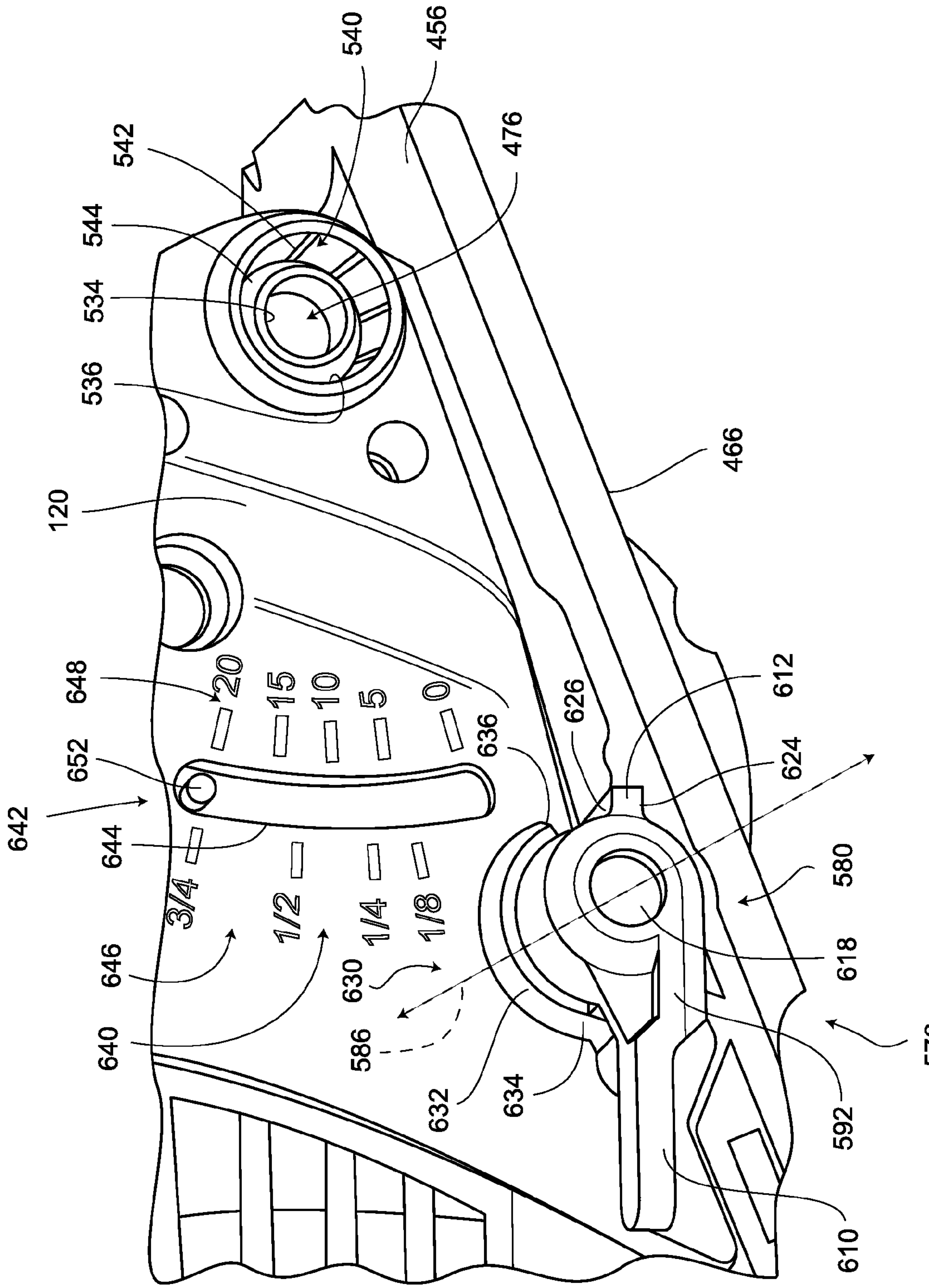
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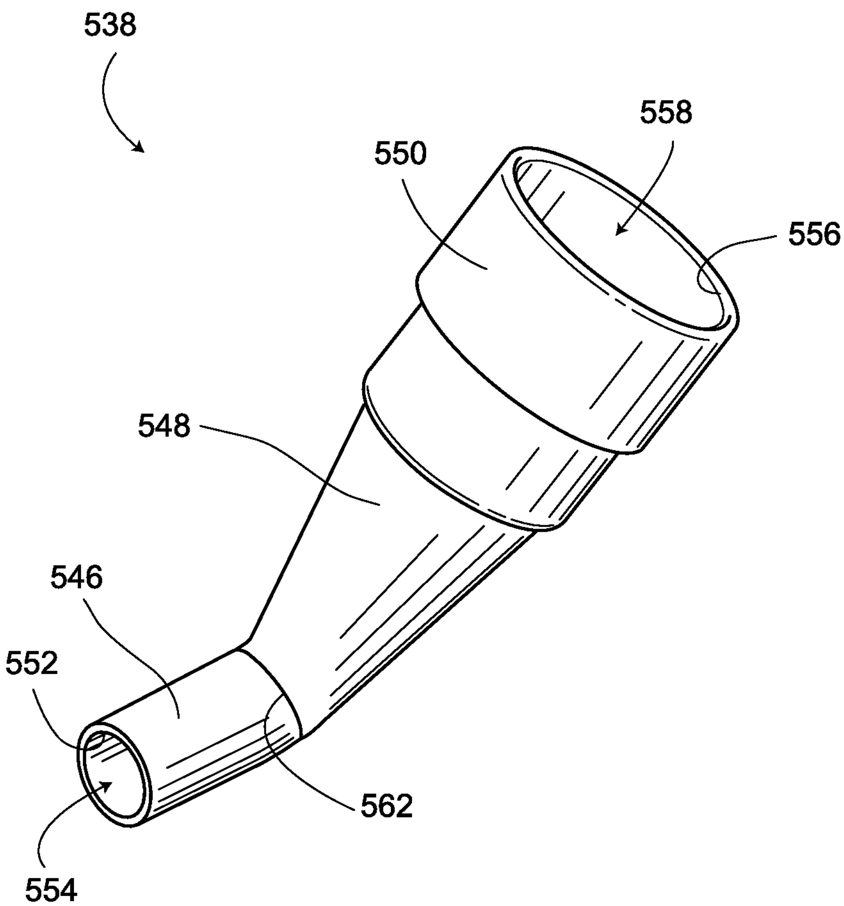
FIG. 27



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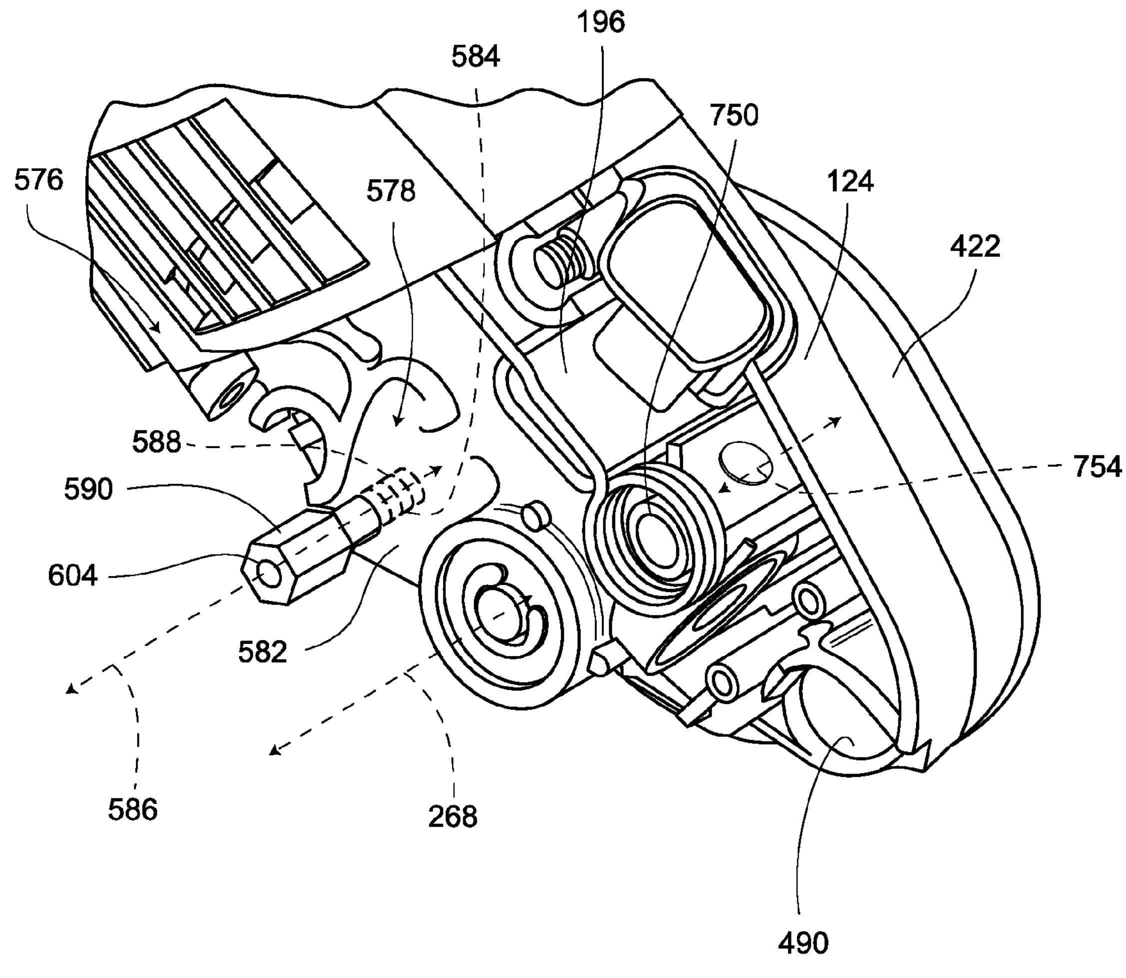

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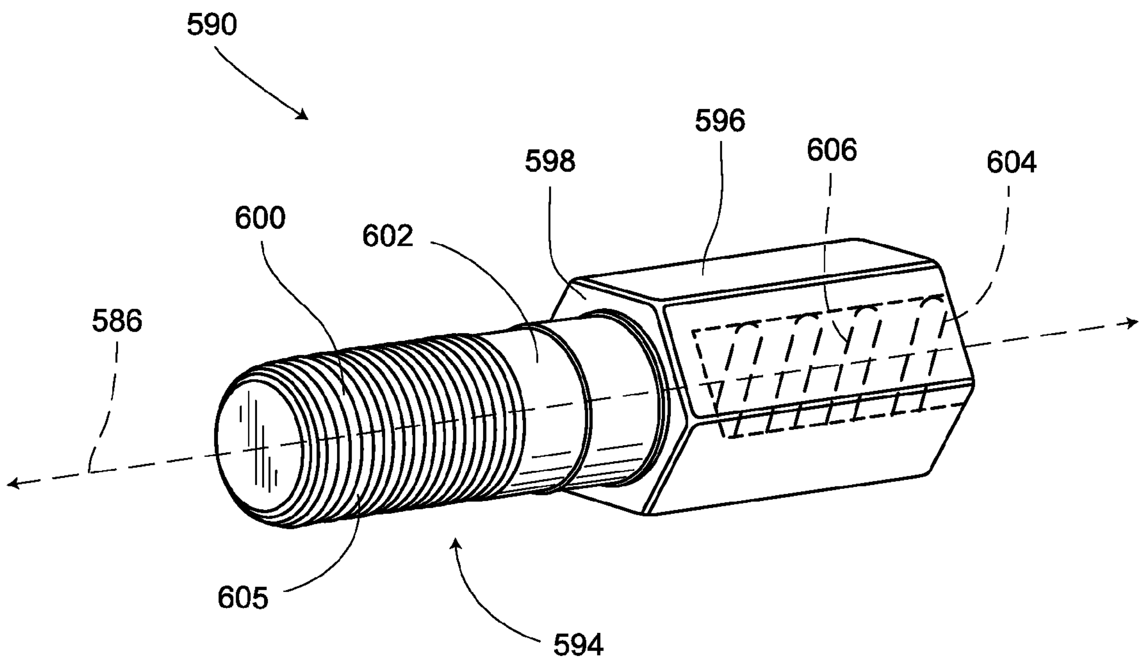
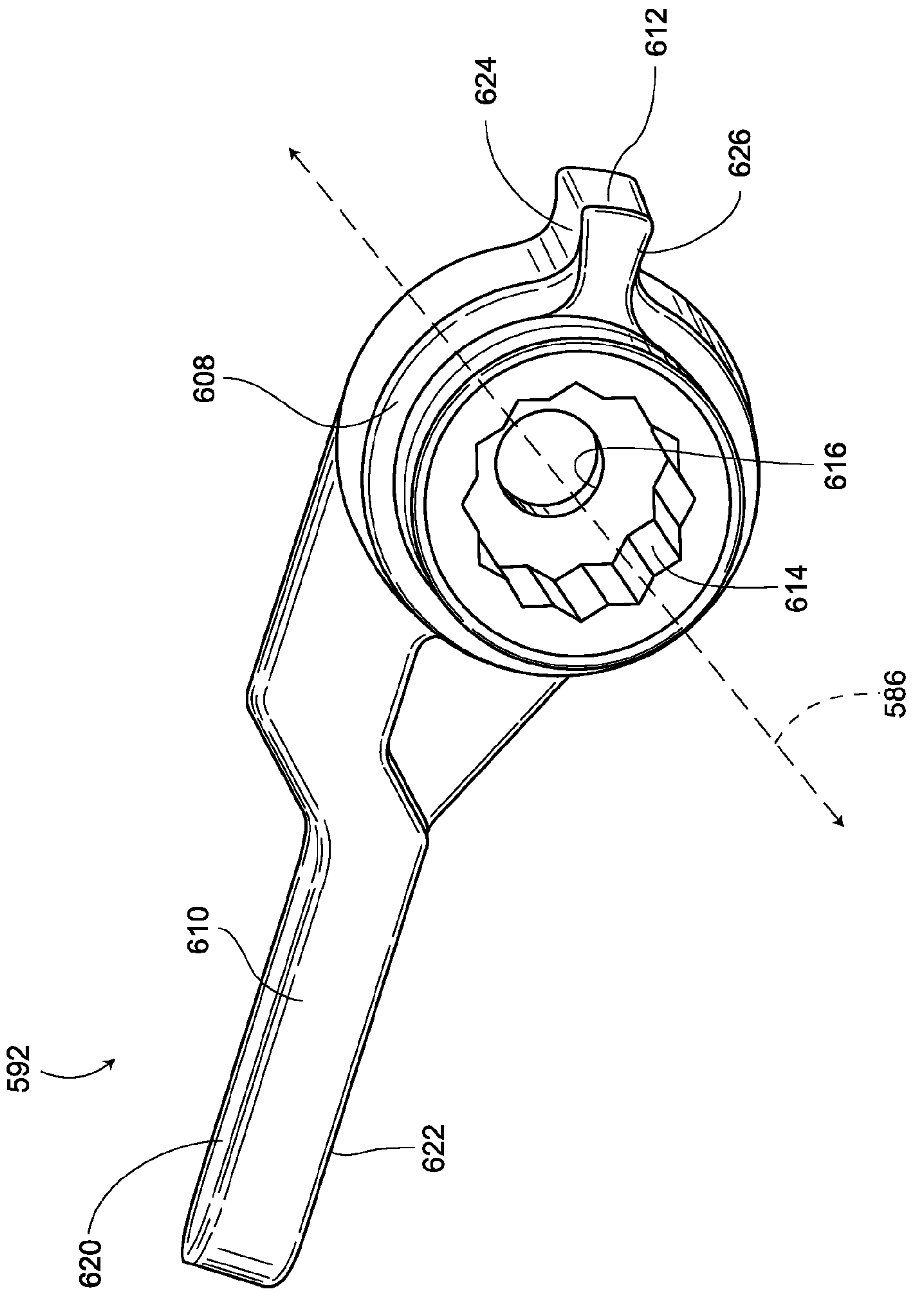


FIG. 30



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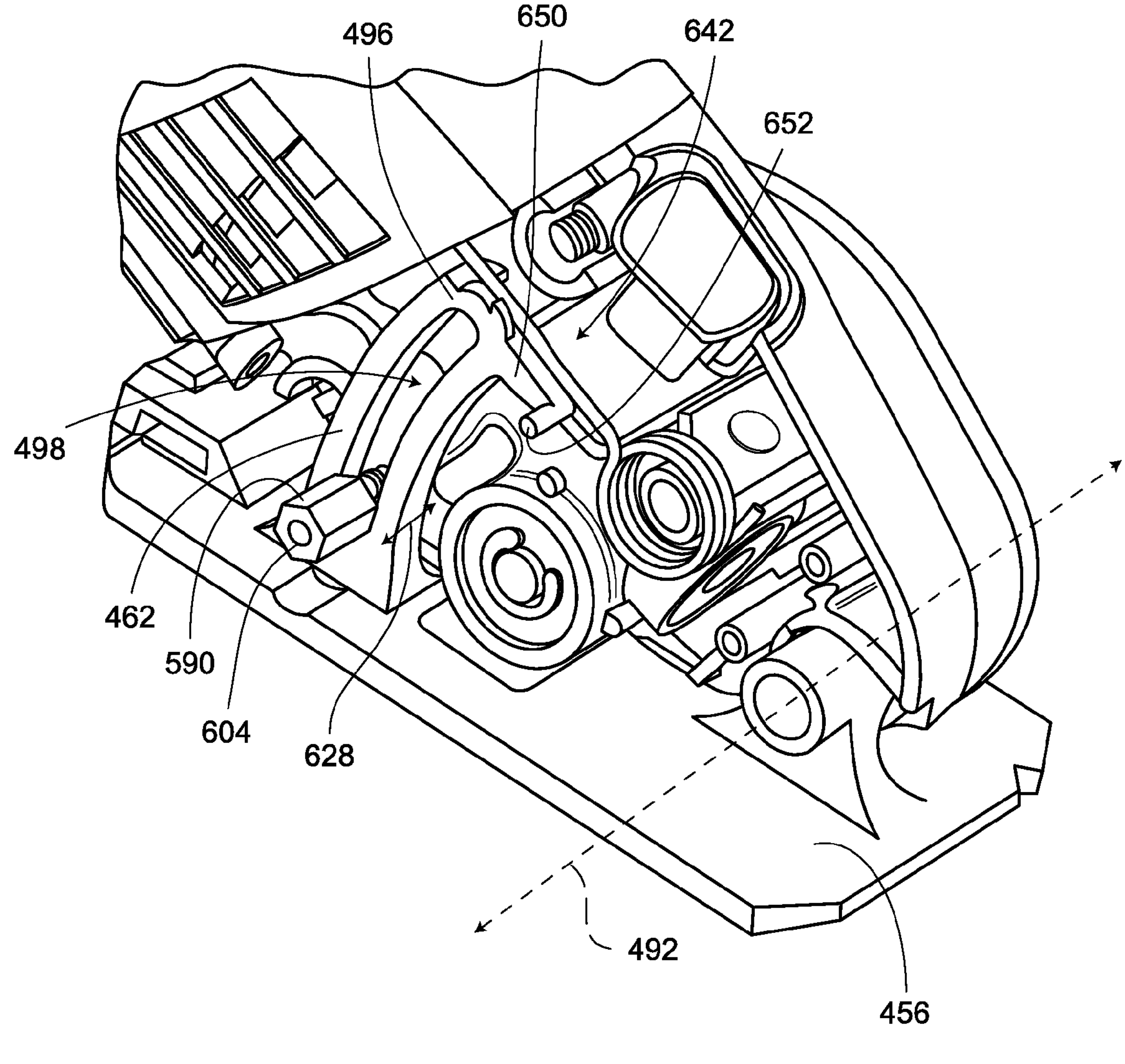

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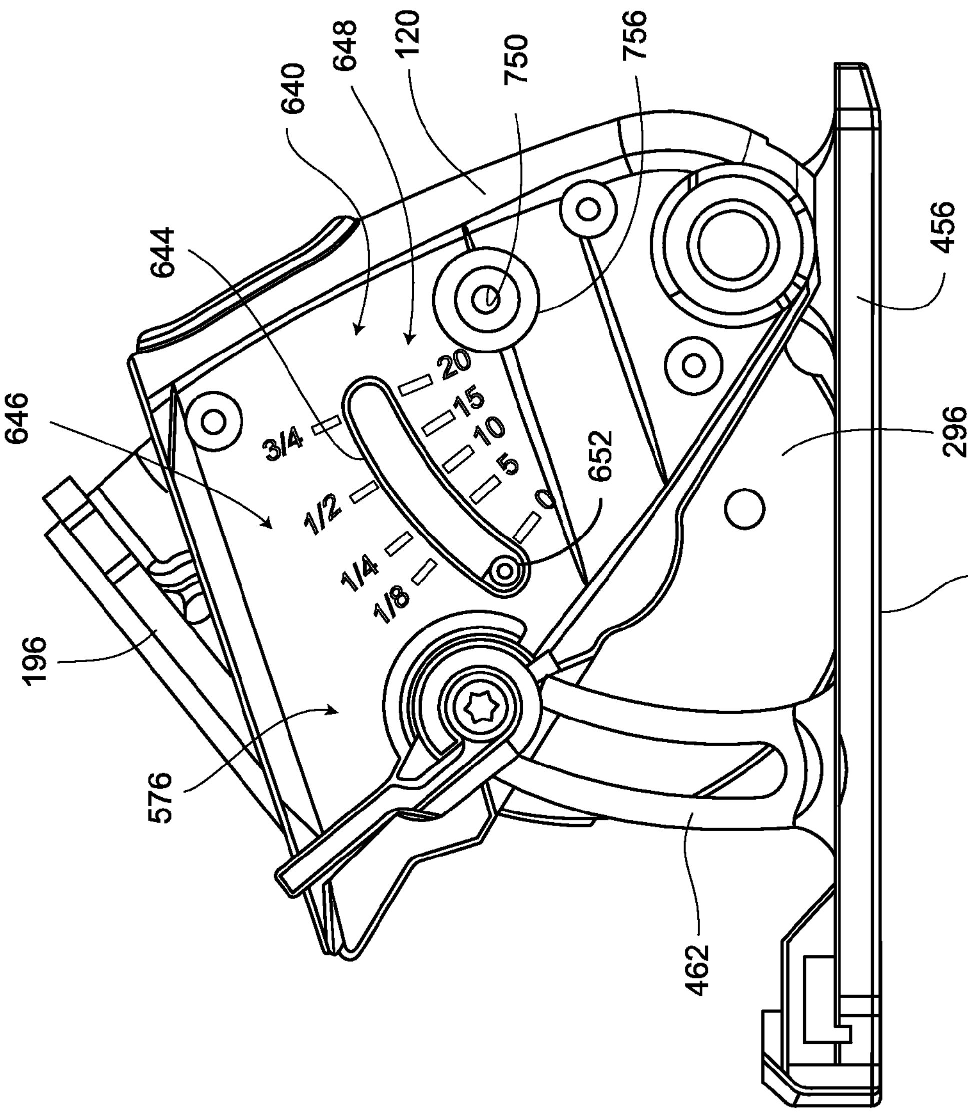
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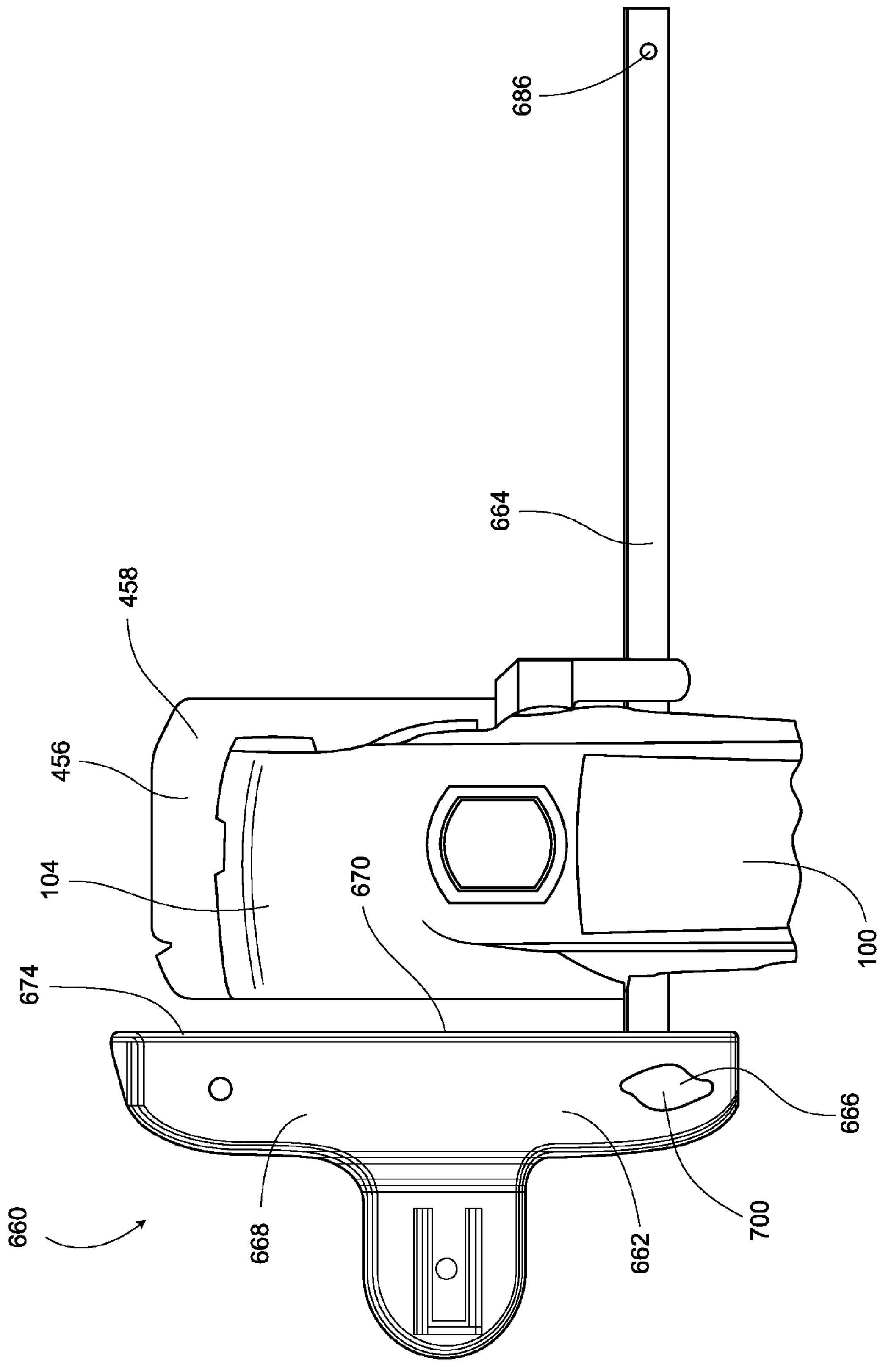
FIG. 33



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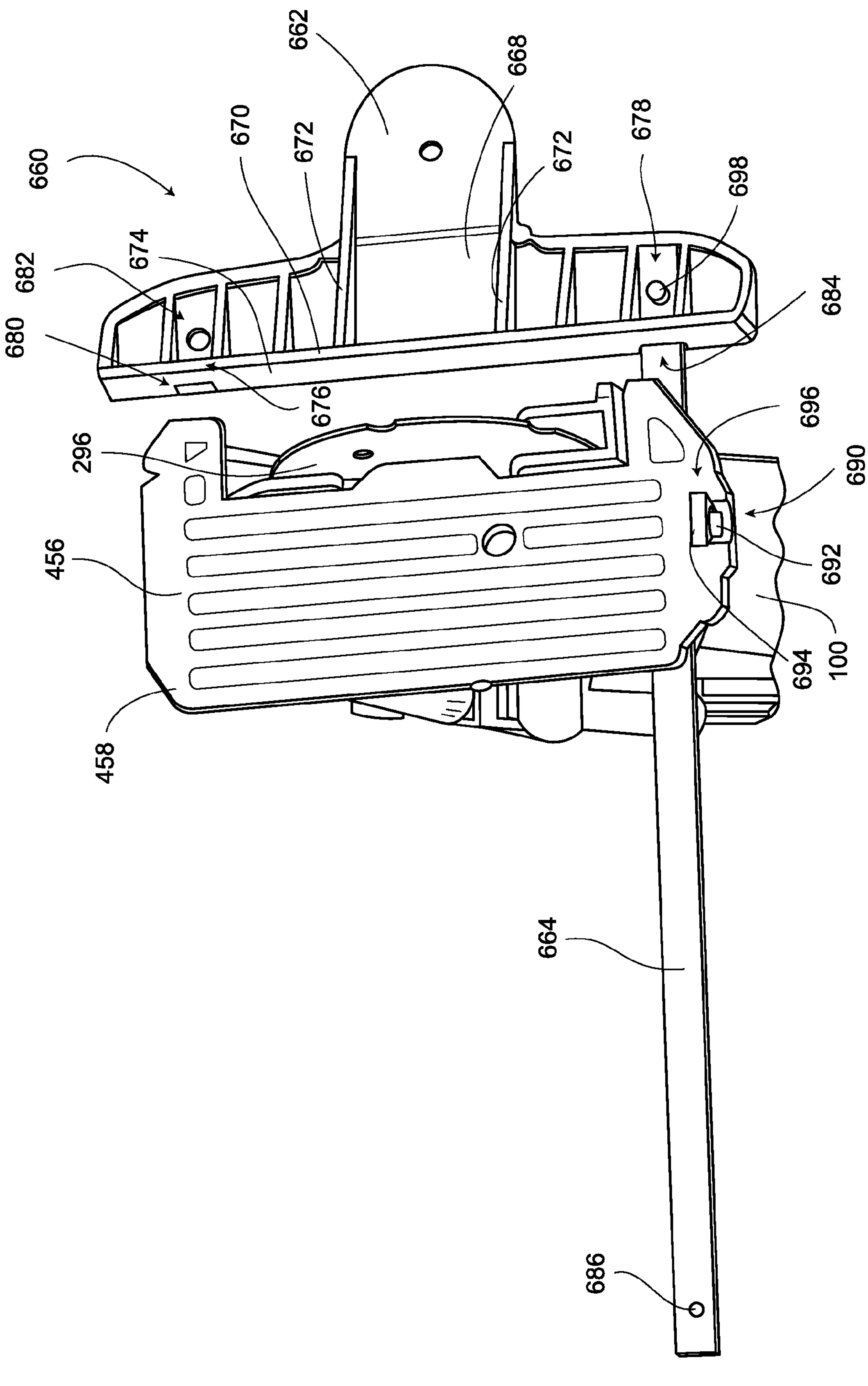
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FIG. 35

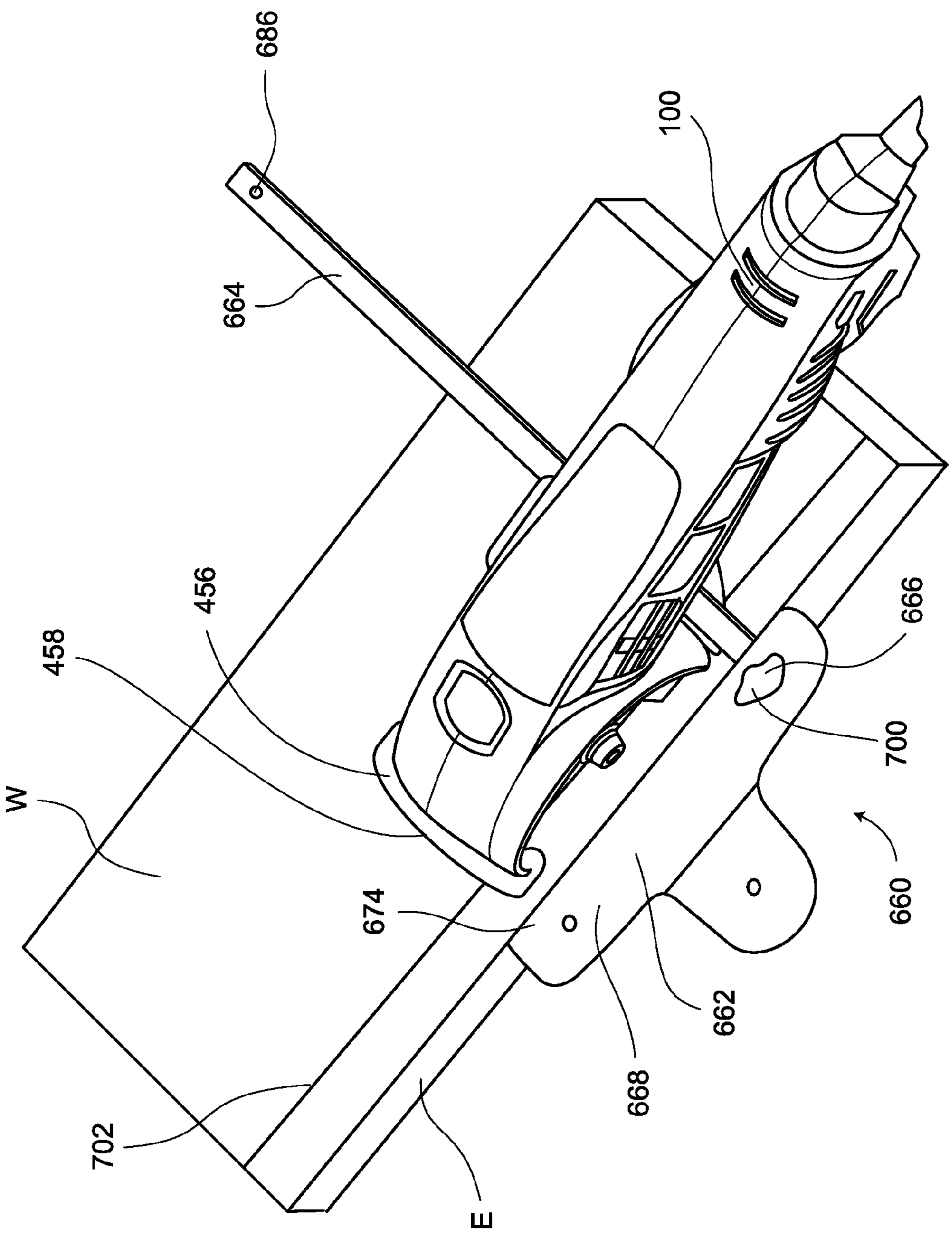
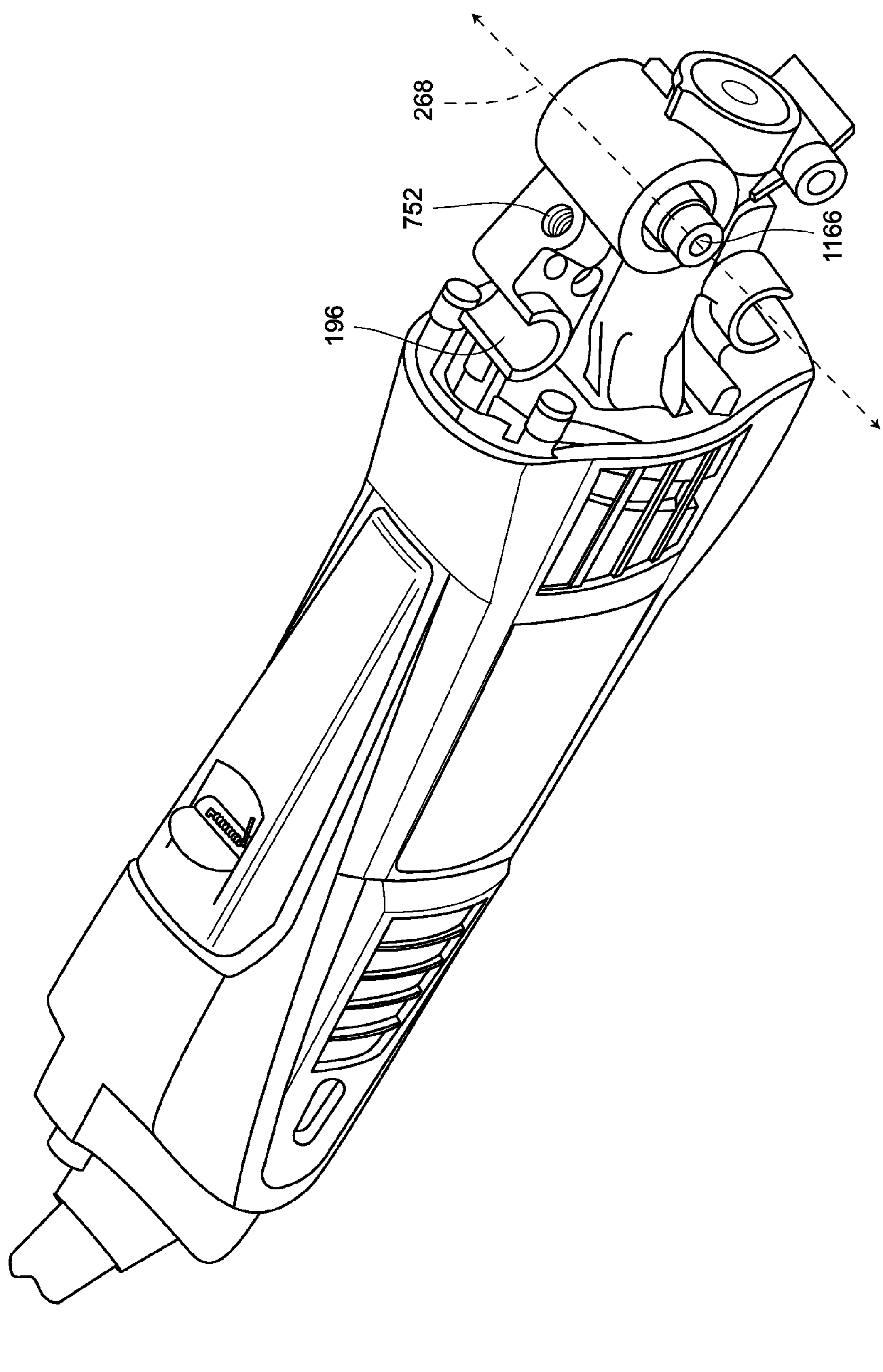


FIG. 36



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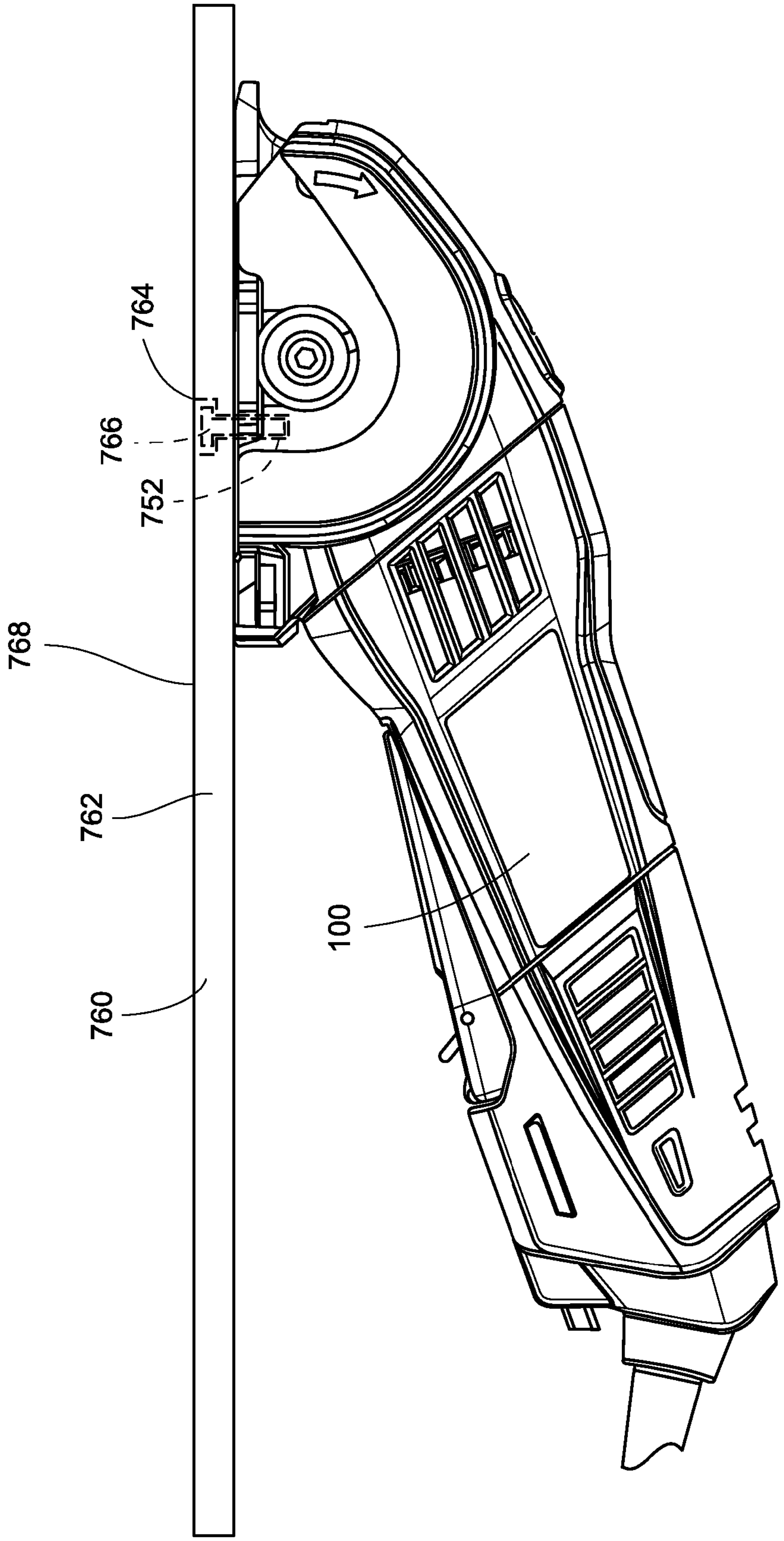

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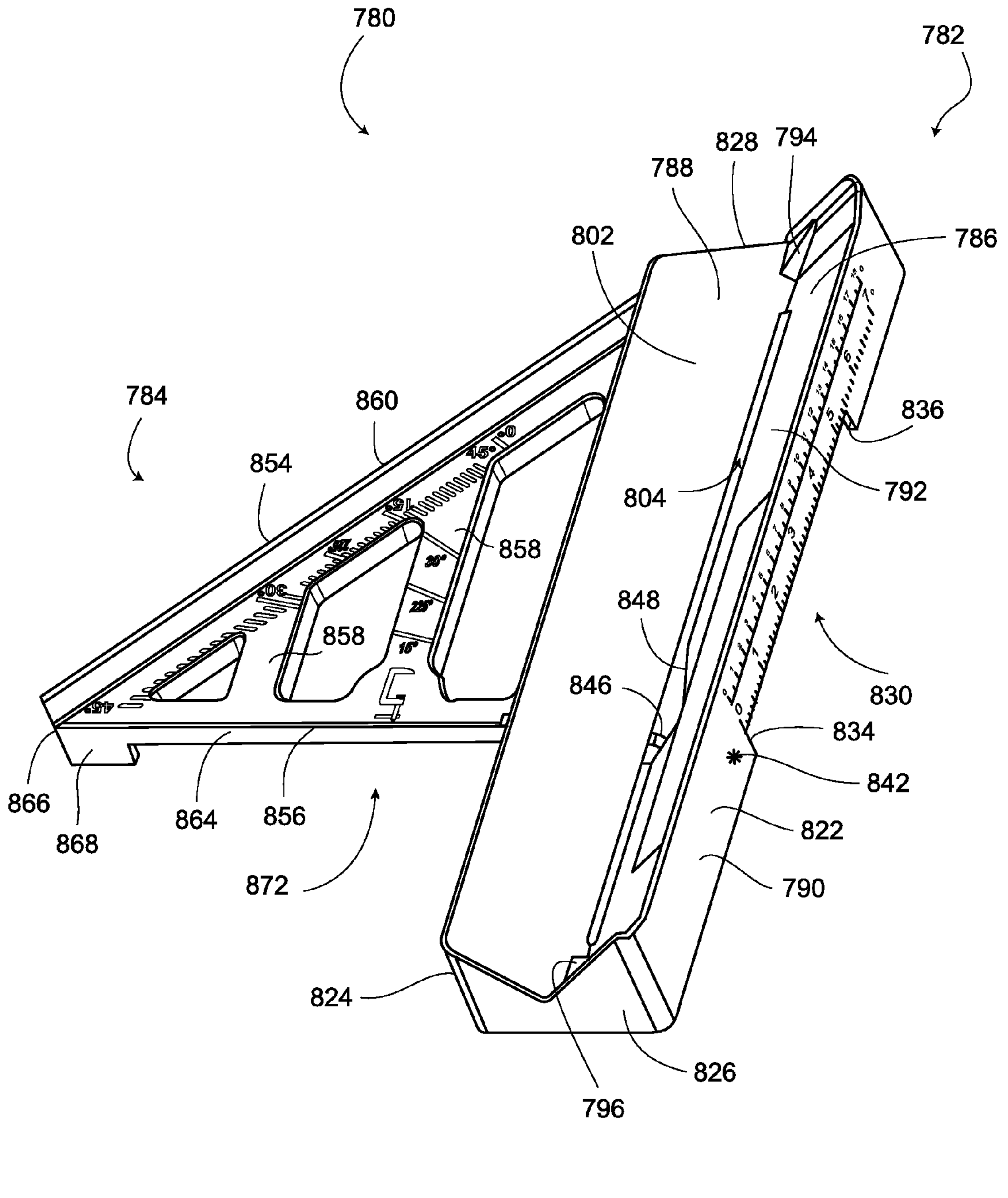
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FIG. 39

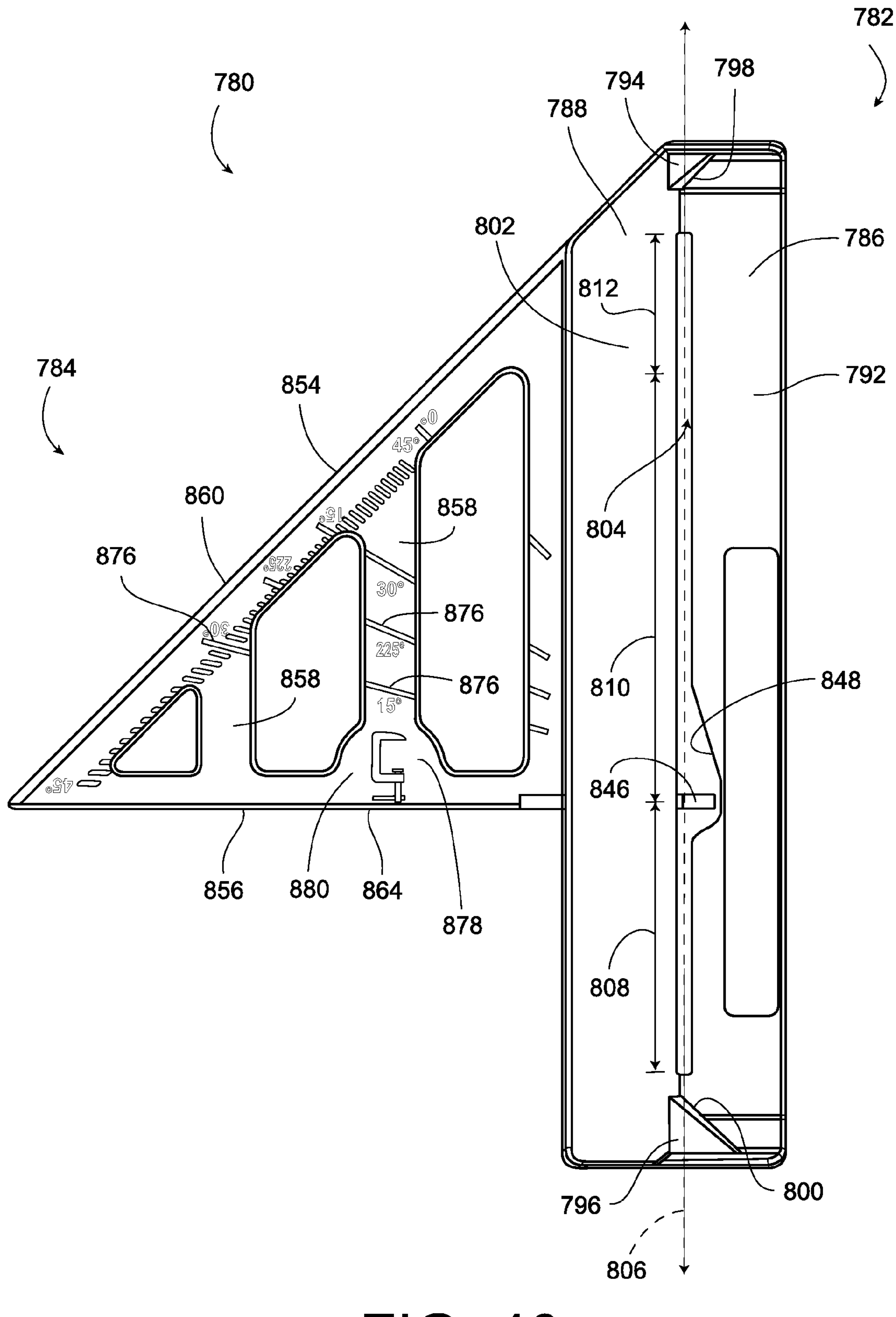

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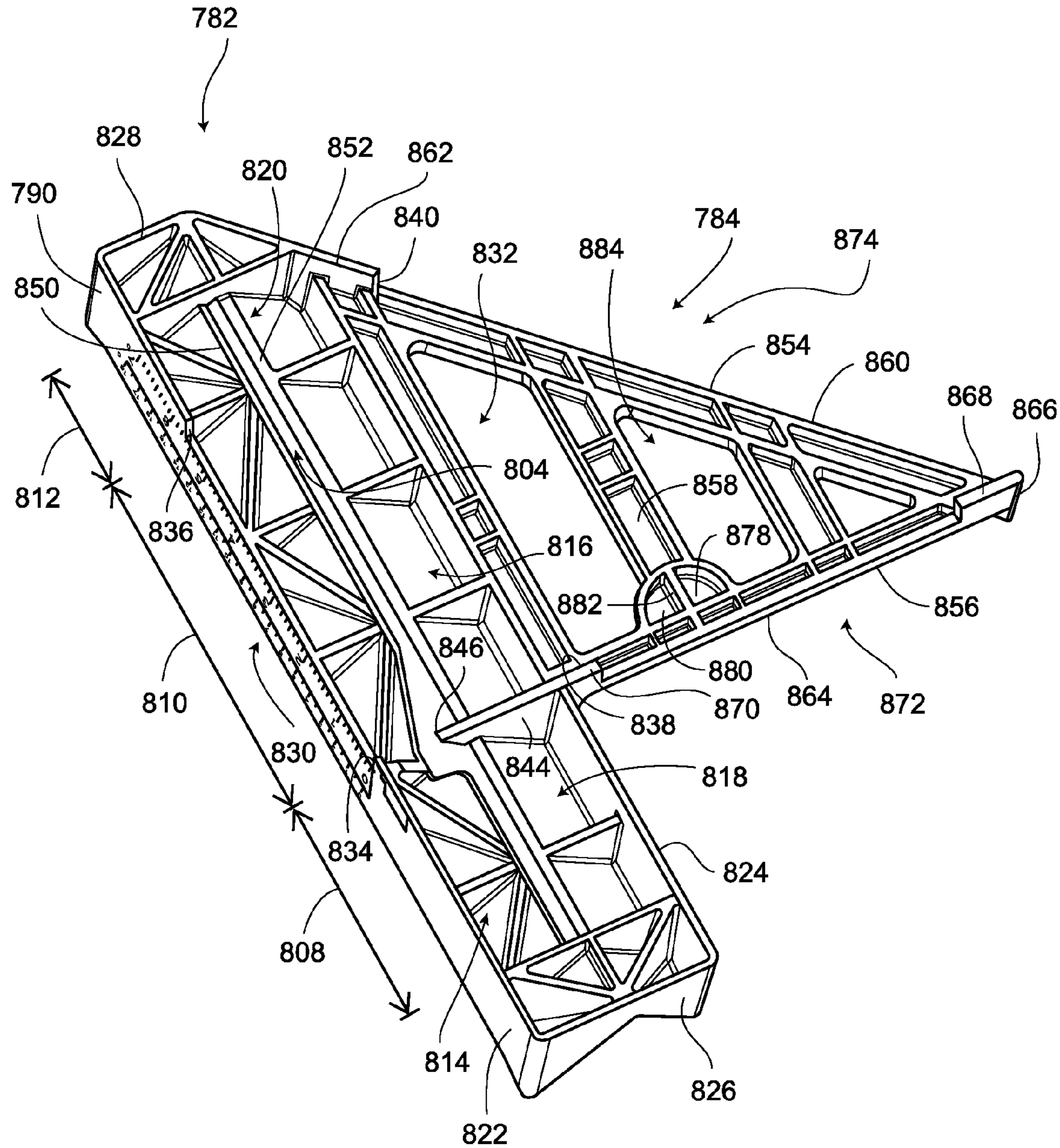
FIG. 40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822

FIG. 41

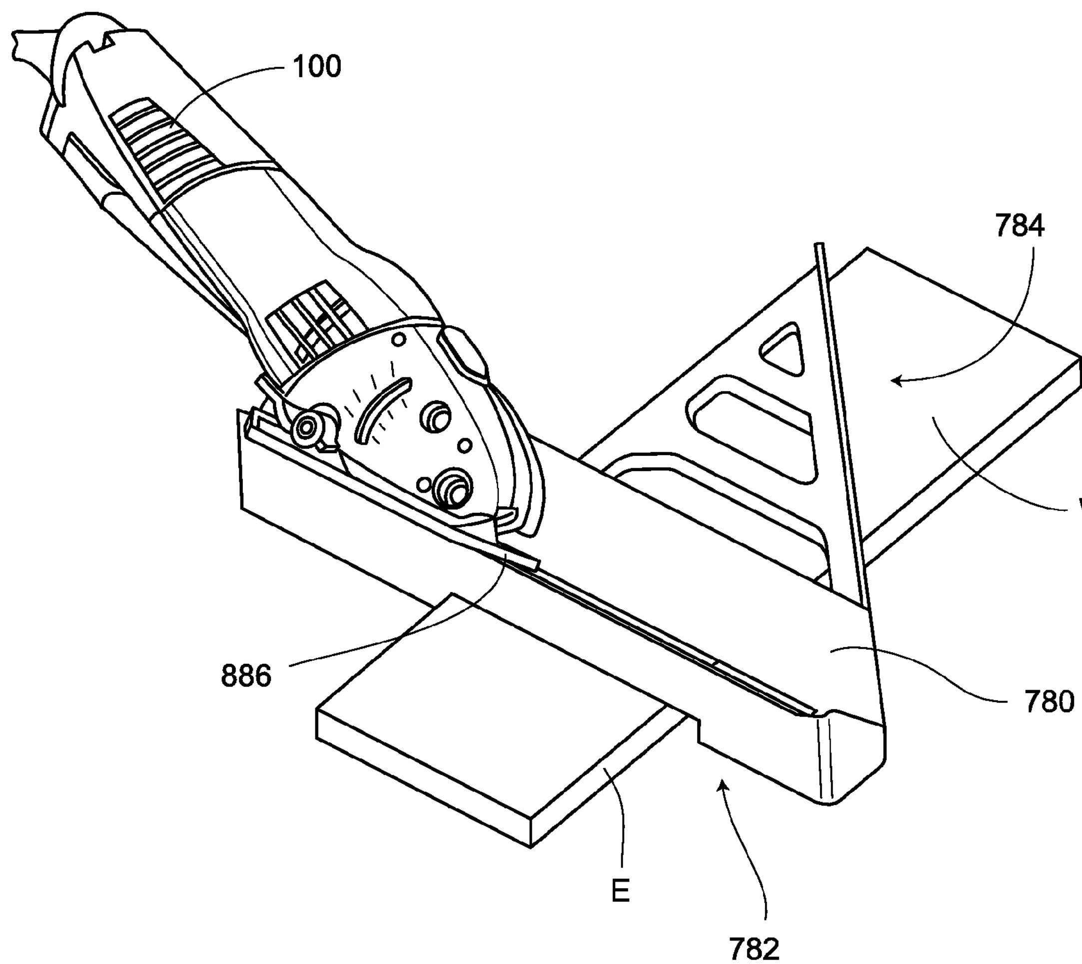


FIG. 42

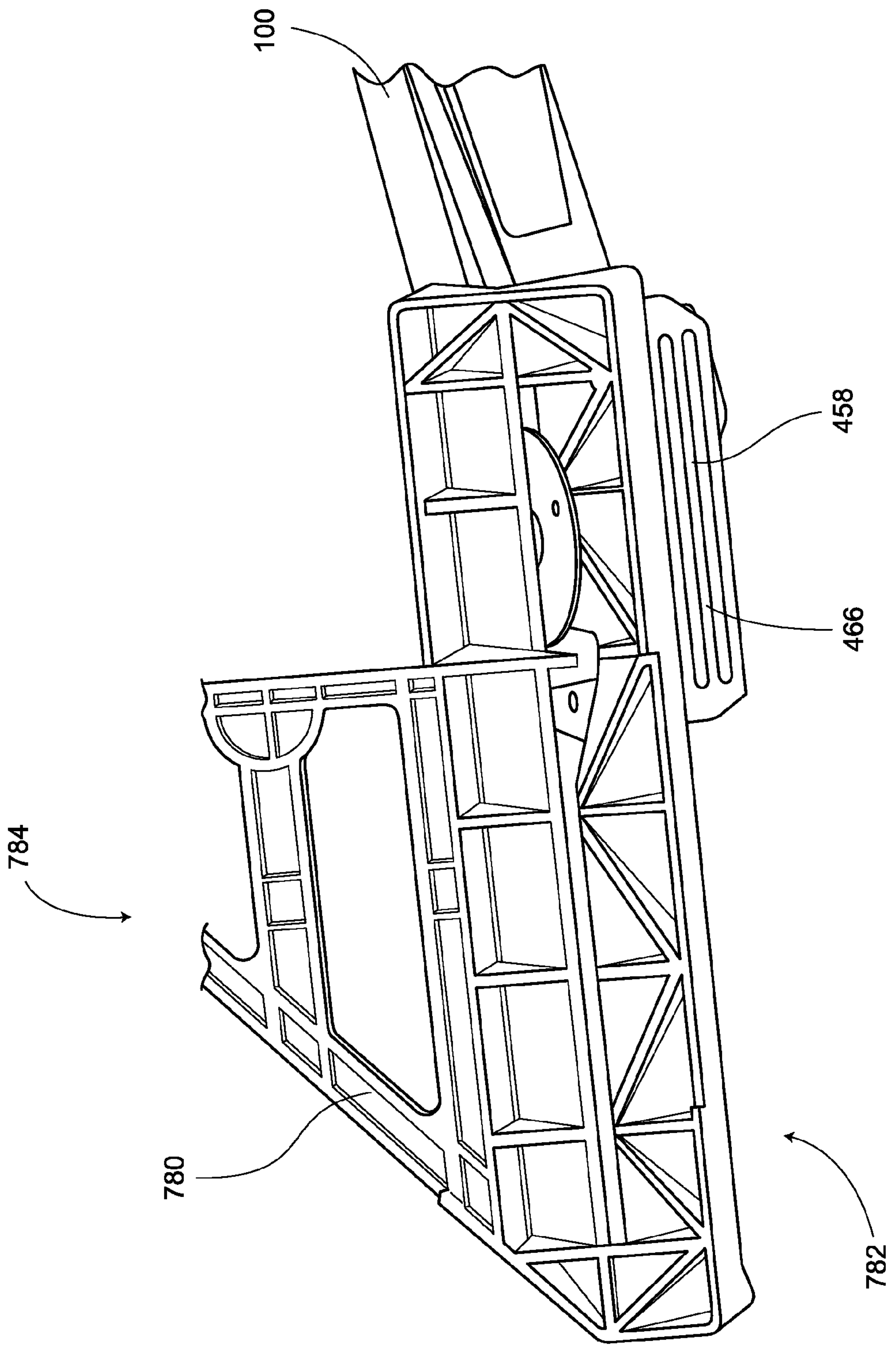


FIG. 43

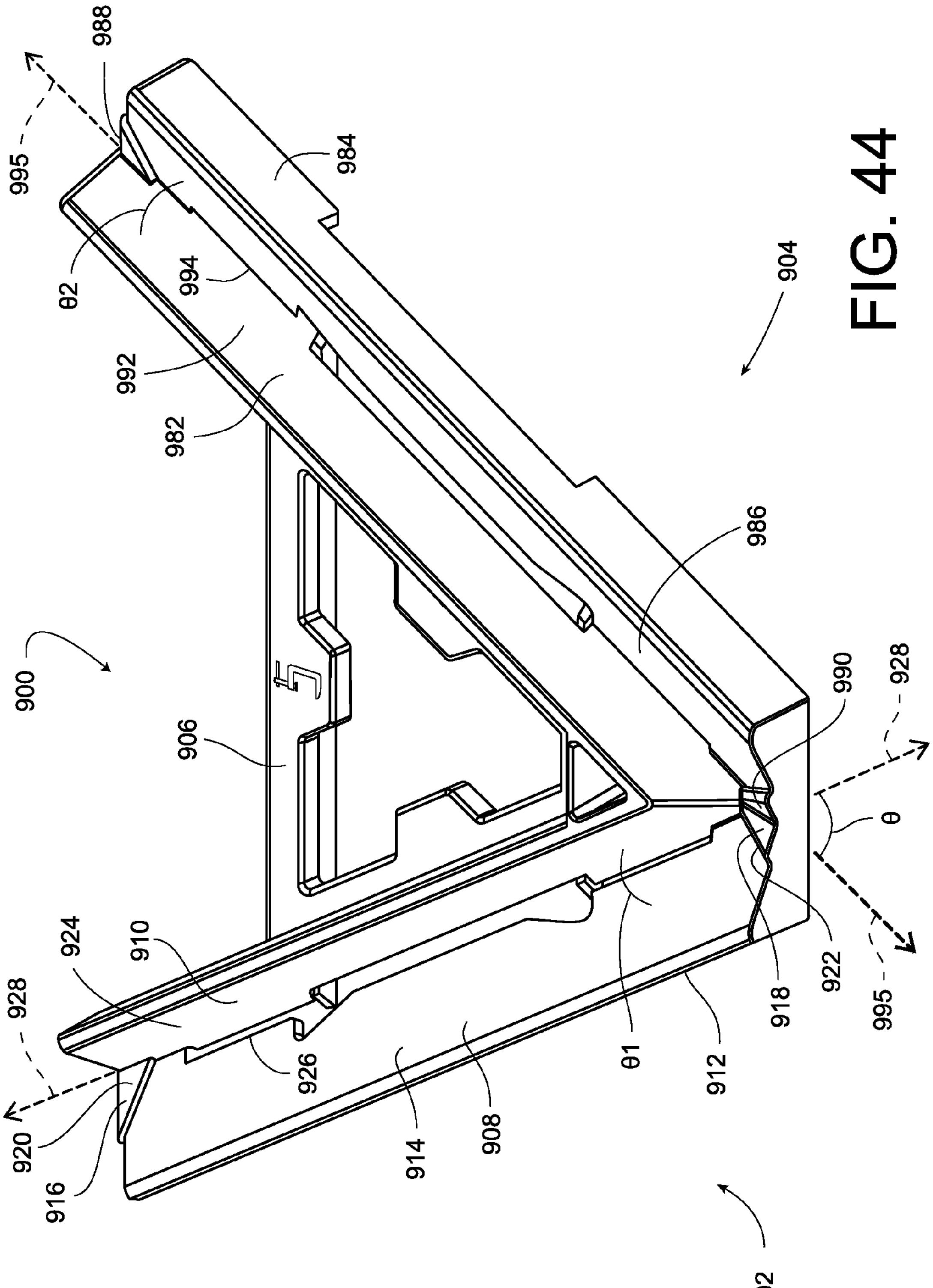
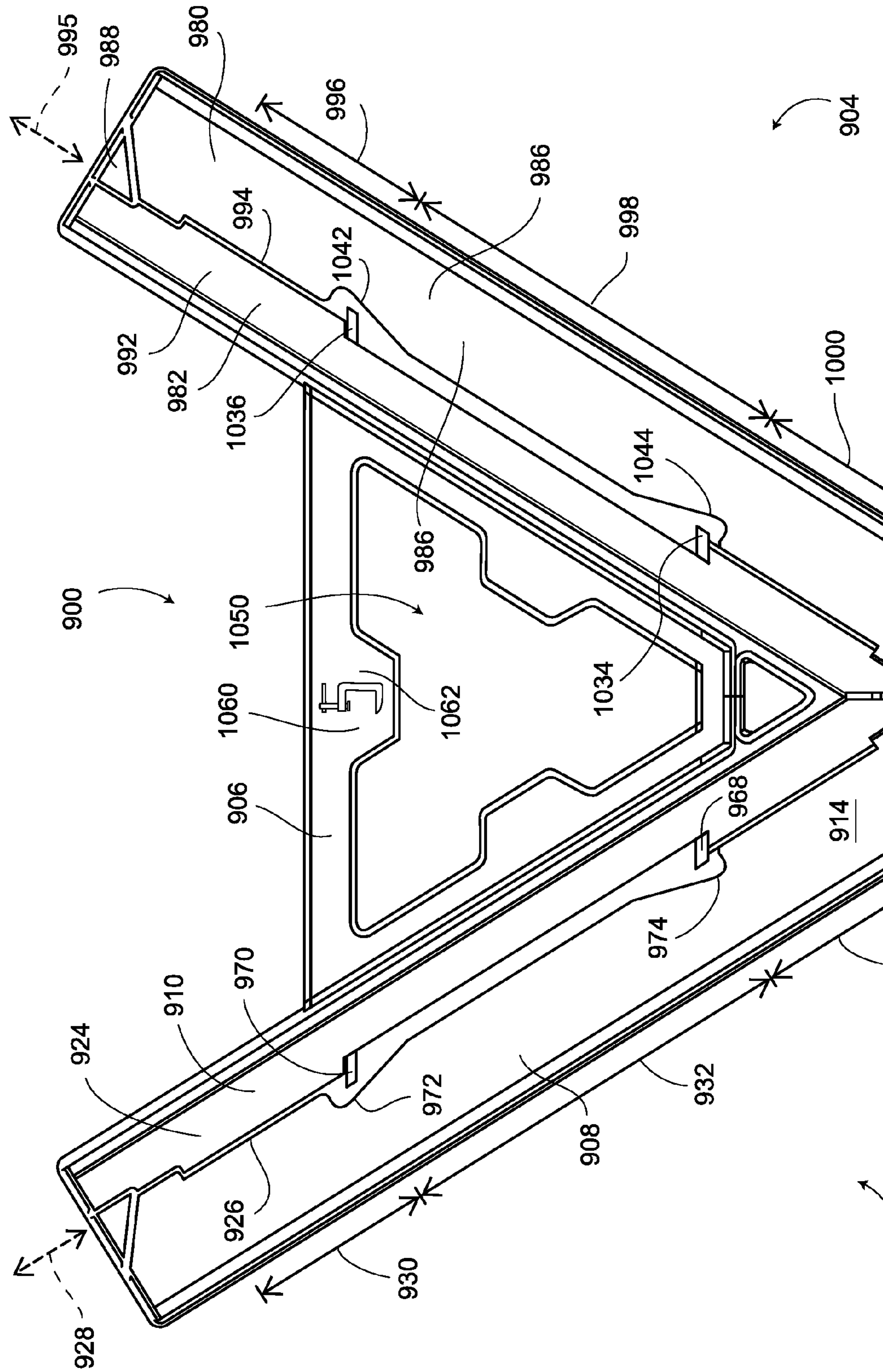

988
995
984
θ2
994
992
982
904
986
900
906
990
928
θ
924
910
928
922
918
995
926
θ1
912
920
916
914
908
902

FIG. 44



995
988
980
996
904
986
998
994
1042
992
982
1036
1000
1044
990
986
900
1050
1034
1060
1062
906
968
914
974
970
910
924
934
972
932
908
926
930
902
928

FIG. 45

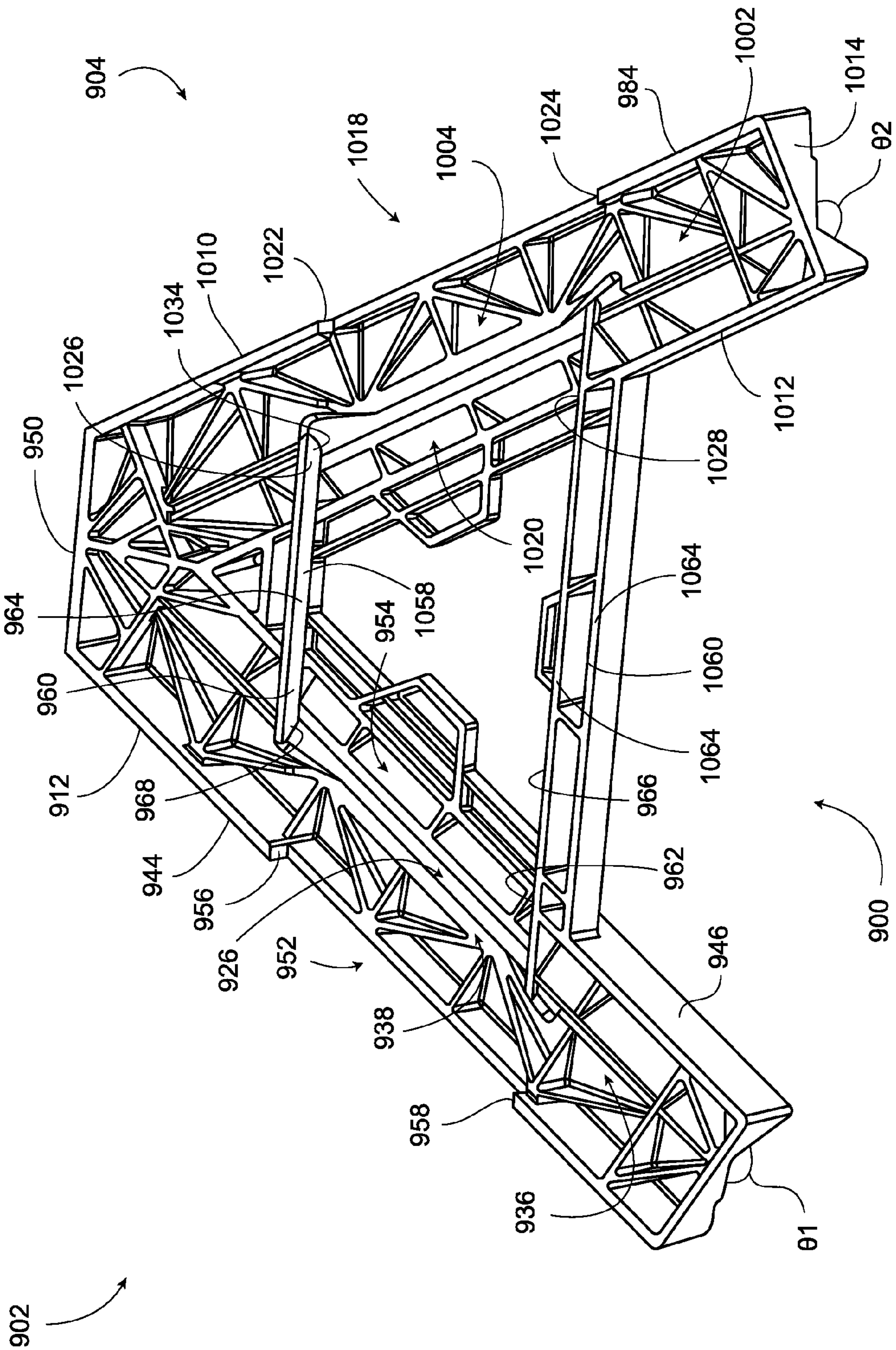
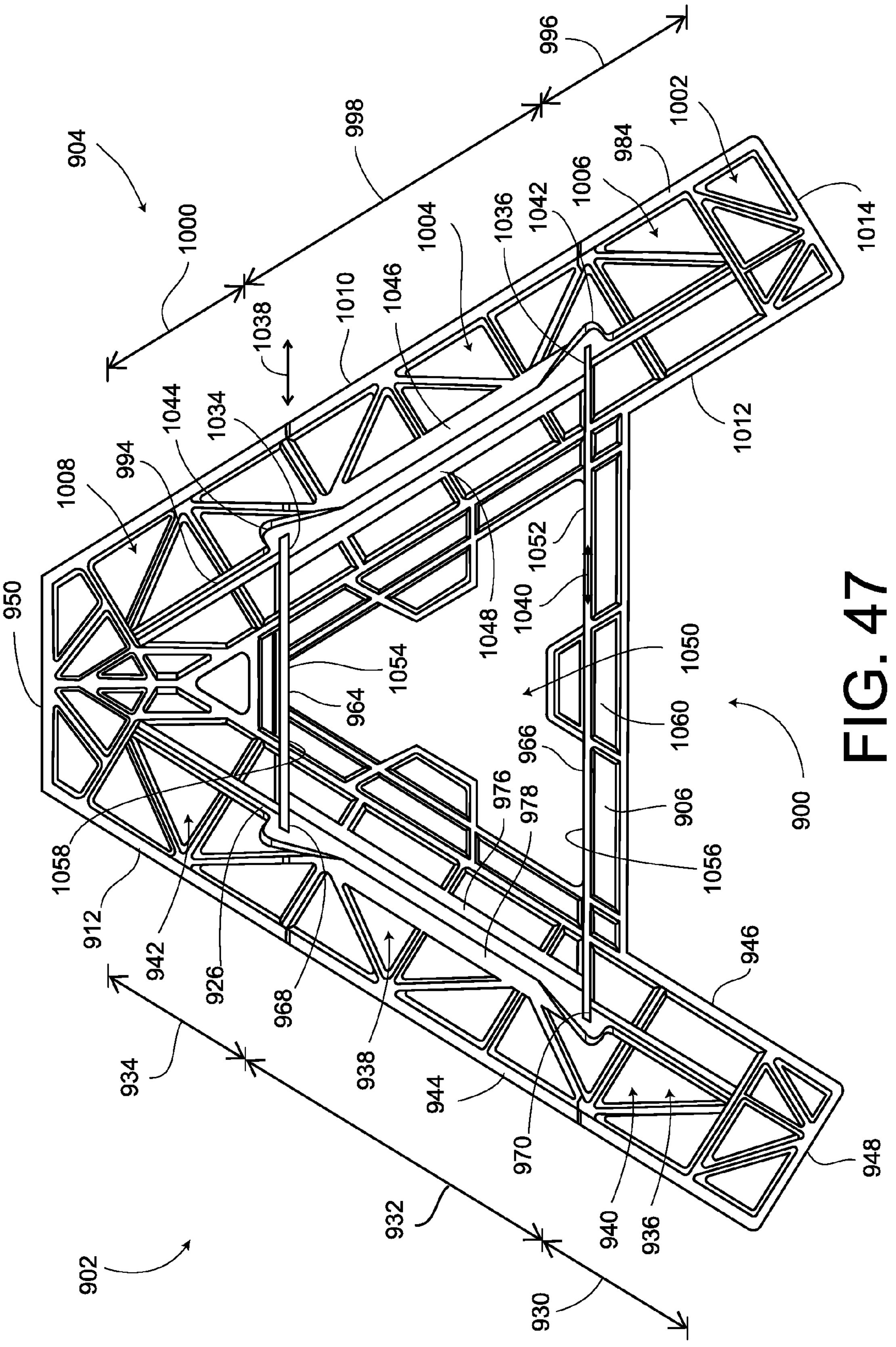

904
1018
1004
1024
984
1002
1014
θ2
1010
1022
1034
1026
950
1012
1028
1020
964
1058
954
1064
1060
1064
960
912
968
966
944
956
962
926
952
946
938
958
936
θ1
902
900

FIG. 46


904
998
996
1000
1002
984
1006
1042
1036
1004
1010
1046
1038
1014
1044
1034
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1008
1012
950
1052
1040
1048
1054
964
1050
1060
966
976
978
906
900
1056
1058
912
942
926
968
938
946
934
944
970
932
940
936
948
902
930

FIG. 47

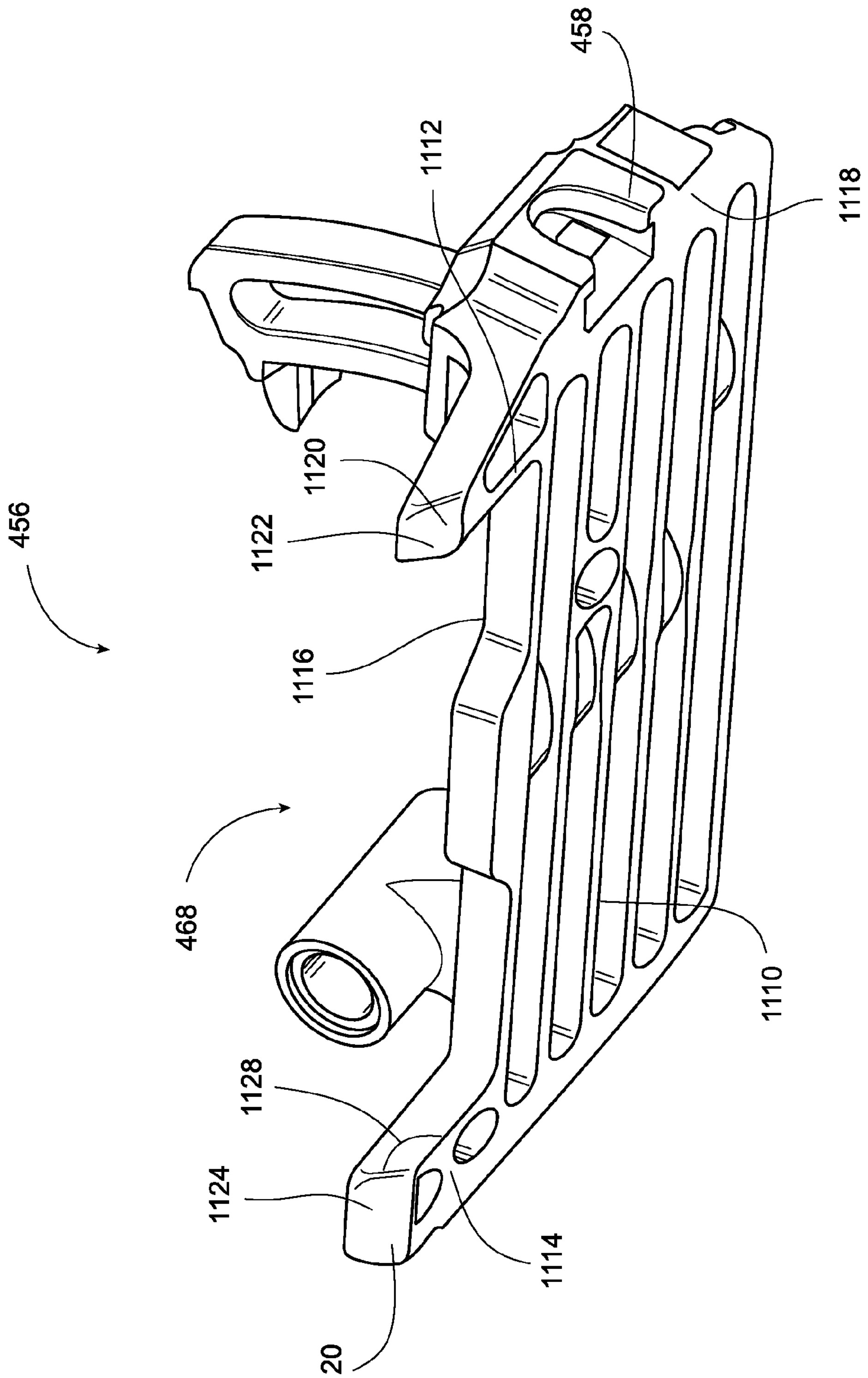

FIG. 48

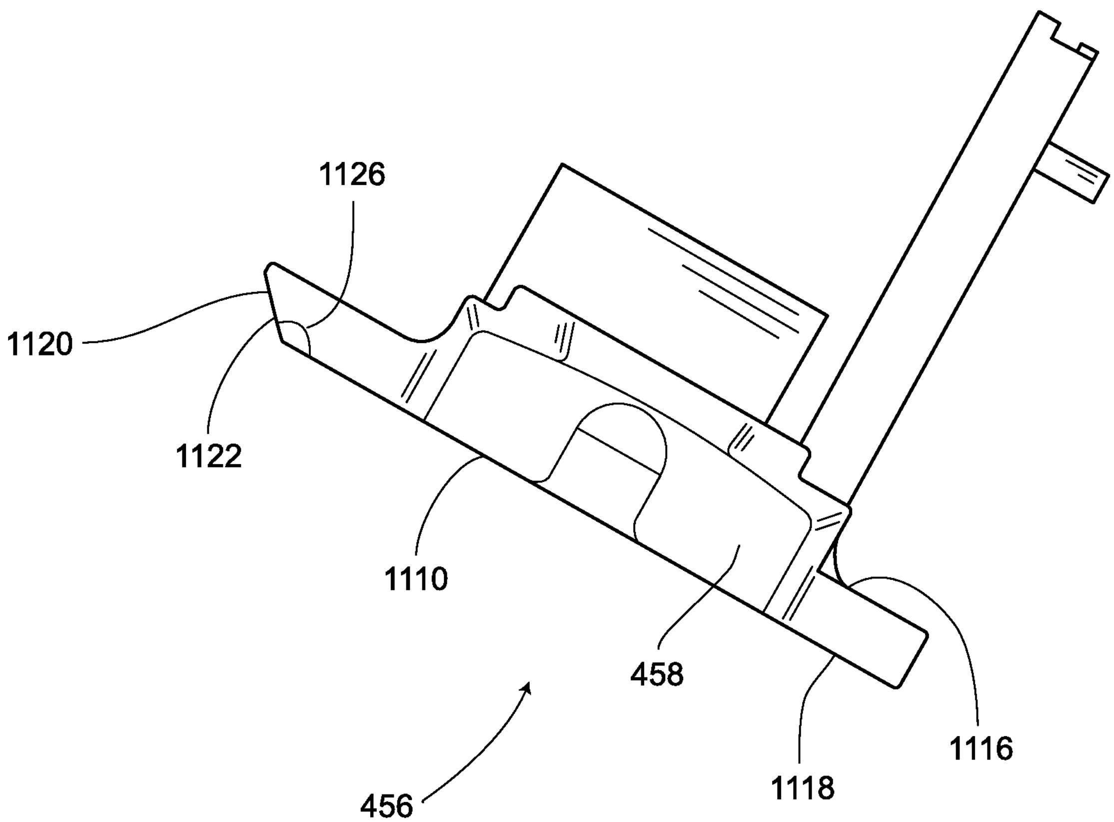

FIG. 49

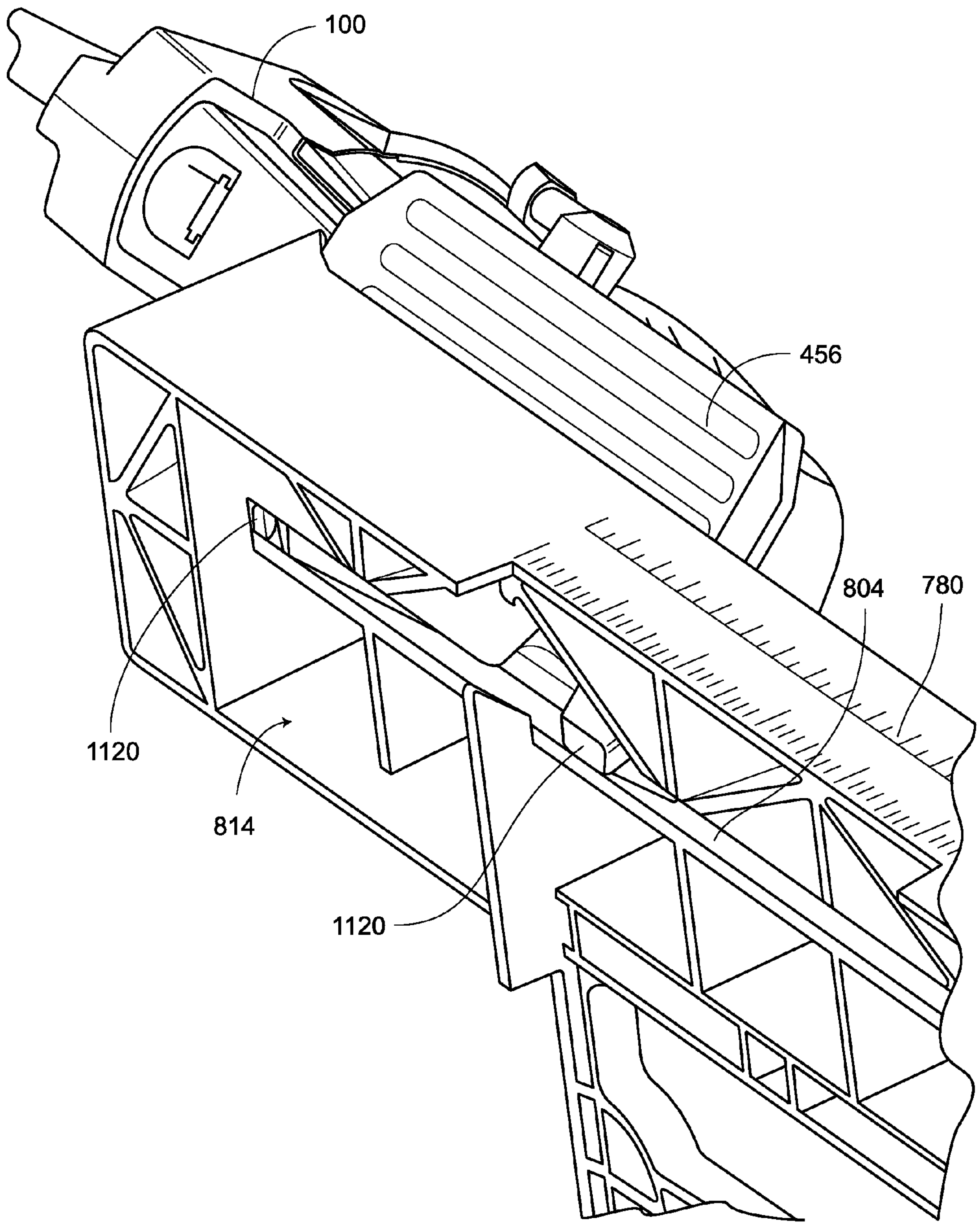

FIG. 50

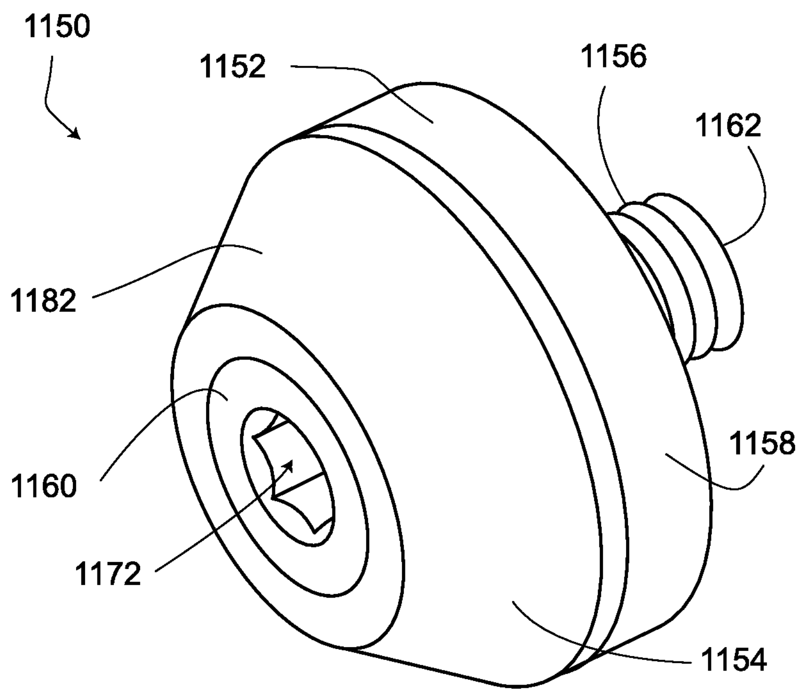

FIG. 51

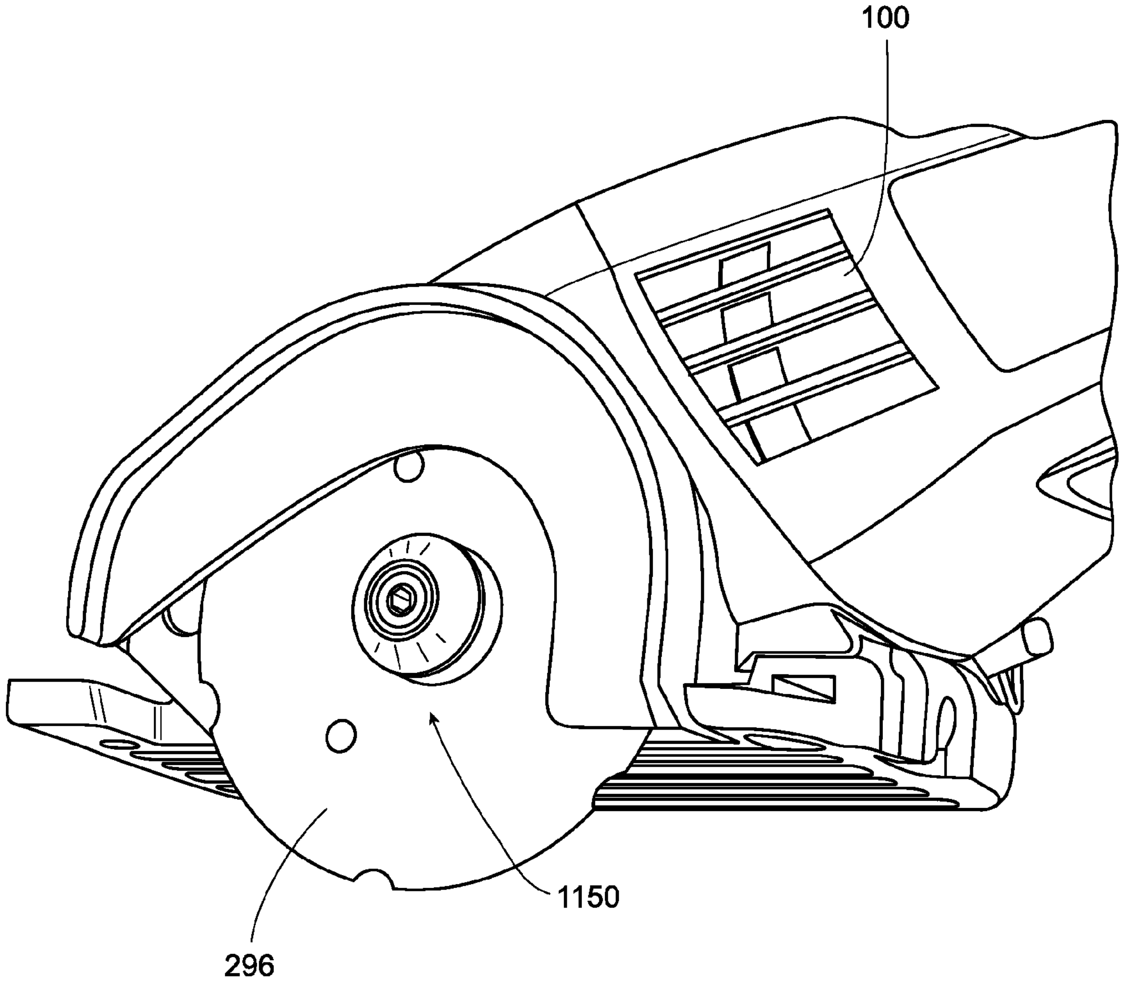

FIG. 52

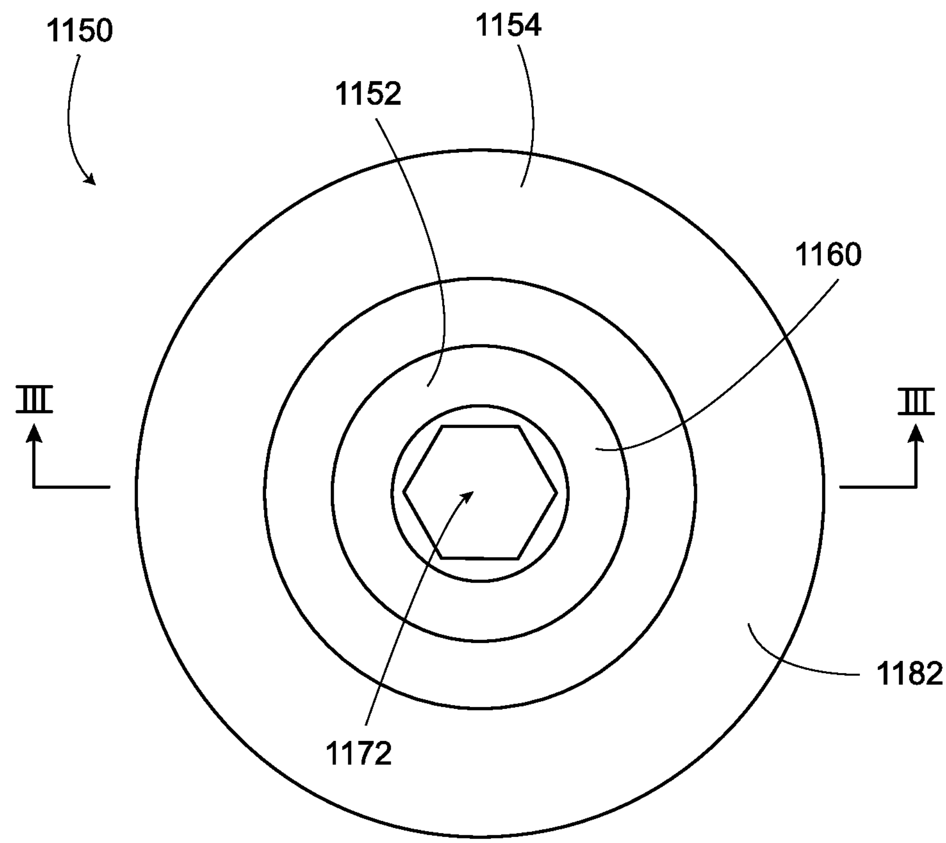

FIG. 53

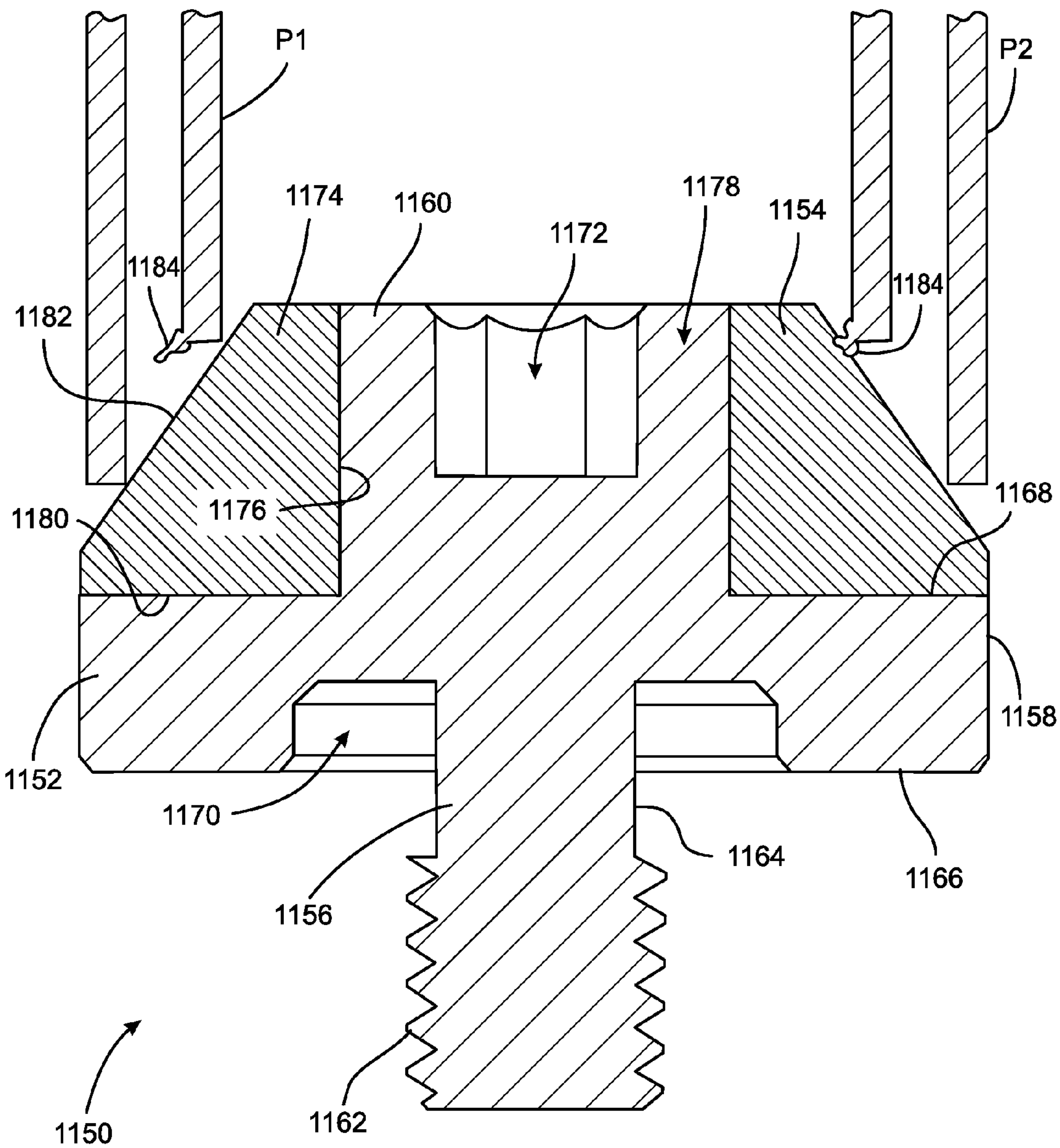
P1
P2
1174
1160
1172
1178
1154
1184
1184
1182
1176
1180
1168
1152
1158
1170
1164
1166
1156
1162
1150

FIG. 54

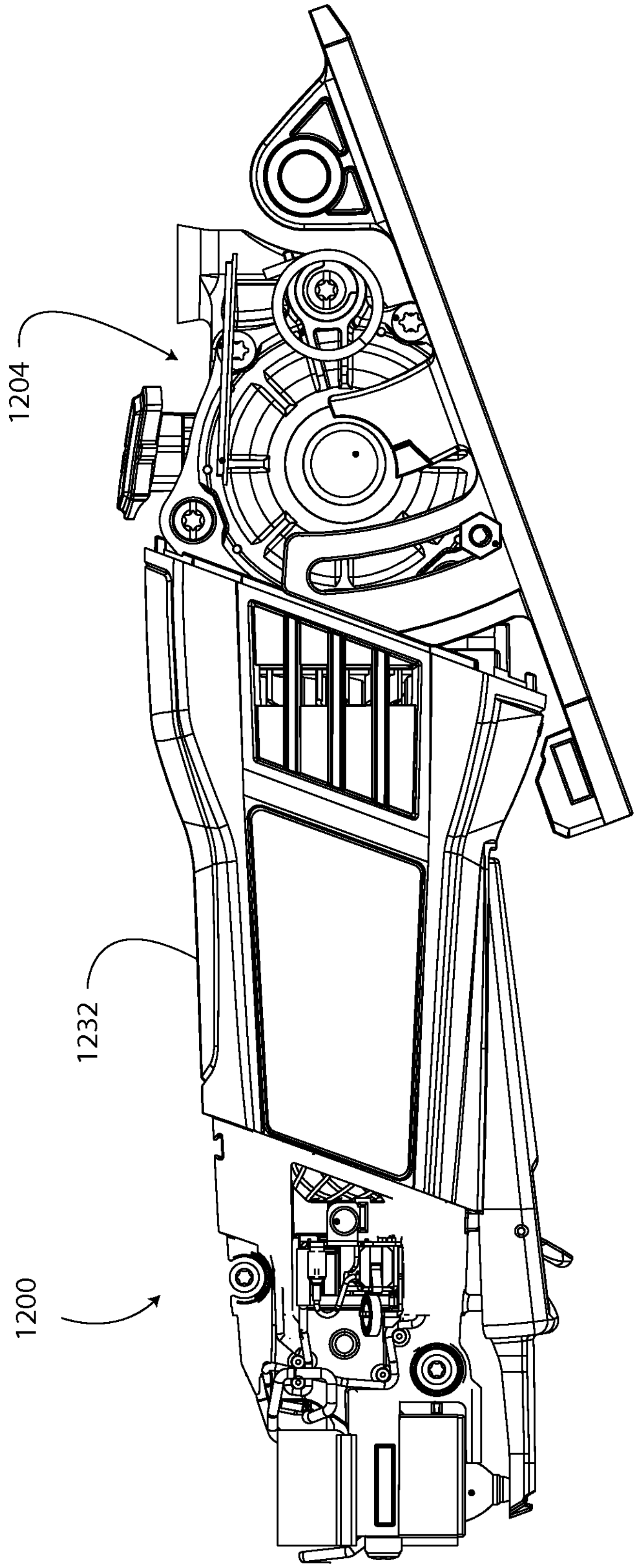

FIG. 55

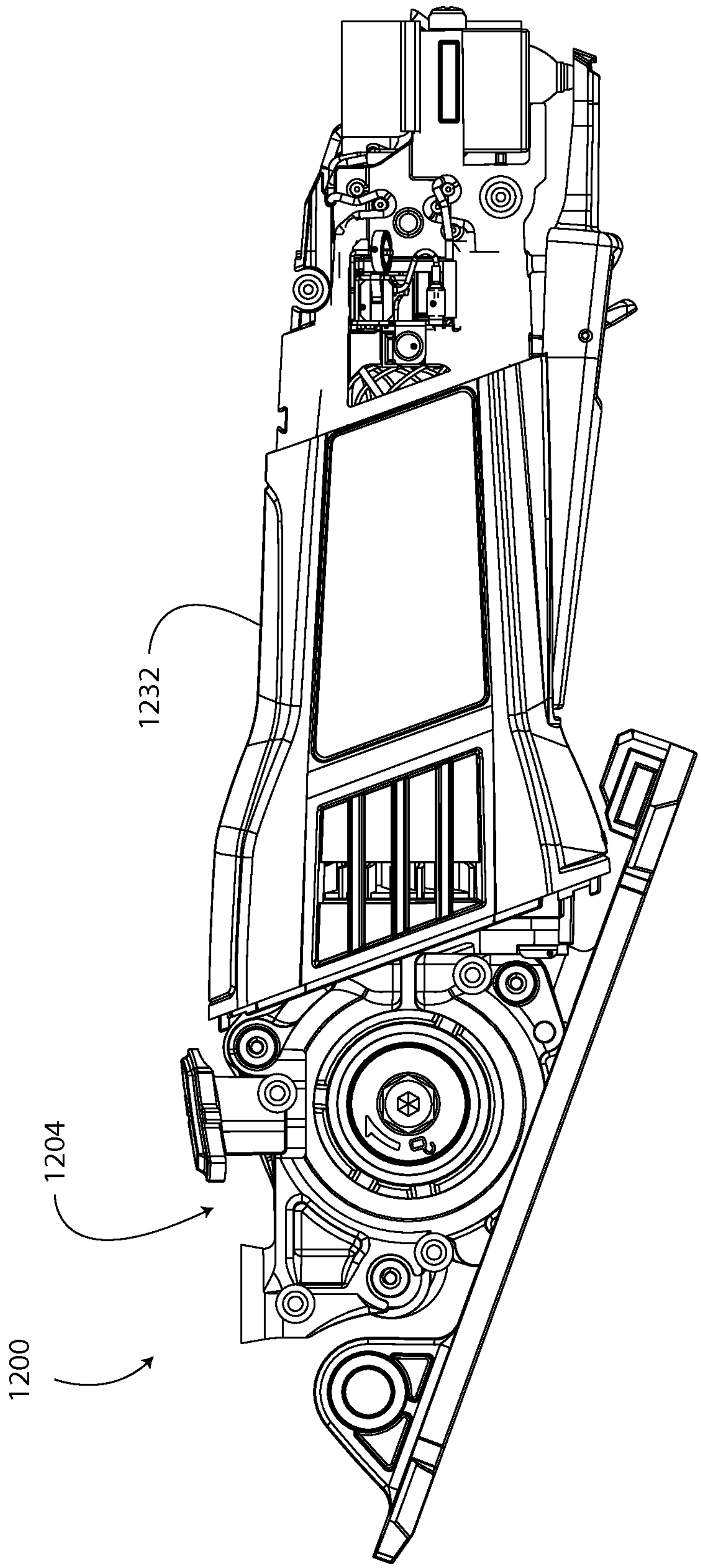

FIG. 56

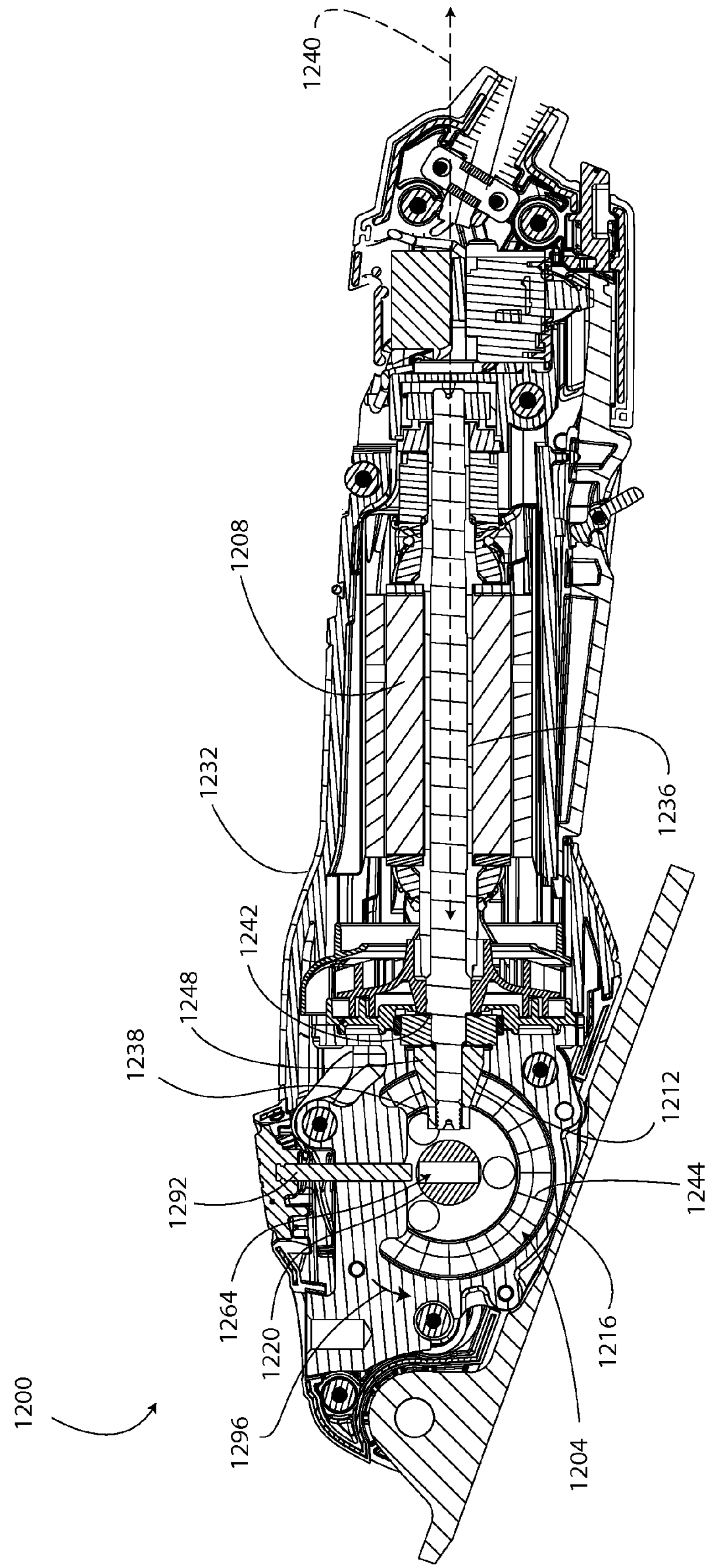
1240
1208
1232
1236
1242
1248
1238
1212
1244
1292
1264
1220
1216
1200
1296
1204

FIG. 57

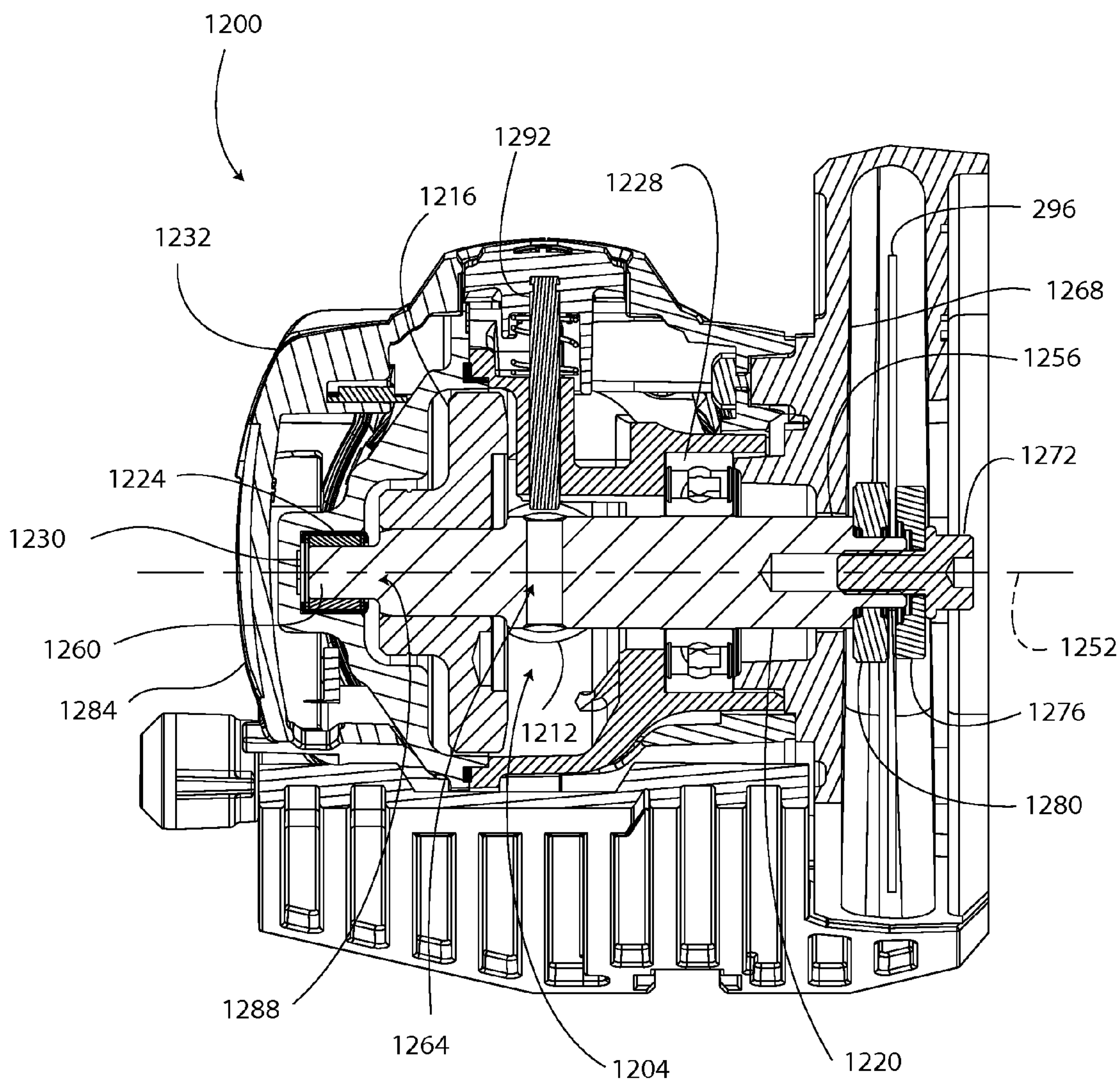
1200
1292
1228
1216
1232
296
1268
1256
1272
1224
1230
1252
1260
1276
1284
1212
1280
1288
1264
1204
1220

FIG. 58

SAW ASSEMBLY WITH BEVEL GEAR DRIVETRAIN

This application is a continuation-in-part of application Ser. No. 13/250,917, filed on Sep. 30, 2011 and issued as U.S. Pat. No. 8,857,067 on Oct. 14, 2014, the disclosure of which is incorporated herein by reference in its entirety.

FIELD

This disclosure relates generally to power tools and particularly to circular saws.

BACKGROUND

Power saws are a type of cutting tool, which are useful for quickly and easily cutting material, such as construction lumber and other building products. A common type of power saw is a portable circular saw, which includes a drivetrain having an electric motor and an arbor assembly configured to be rotated by the electric motor. A circular saw blade is coupled to the arbor assembly for rotation with the arbor assembly. Typically, the saw blade extends through a footplate of the circular saw to position the saw blade for contact with a workpiece. A user prepares for cutting the workpiece with the circular saw by resting the footplate on the workpiece and aligning the saw blade with a desired cut path. Then the user energizes the electric motor and manually guides the rotating circular saw blade in the direction of the cut path, often following a marked line on the workpiece.

The drivetrain of some circular saws includes a geared transmission assembly arranged between the electric motor and the arbor assembly. Geared transmission assemblies are useful for, among other things, changing the rate at which the saw blade is rotated relative to the rate of rotation of the electric motor. Furthermore, some types of geared transmission assemblies are capable of transmitting high levels of torque for cutting thick and/or hard workpieces.

In some instances a geared transmission mission assembly may generate an undesirable level of heat within the housing (i.e a gearbox) of the power saw. Thus, it is desirable to provide a geared drivetrain for circular saw that effectively transfers torque from the electric motor to the arbor assembly and the circular saw blade without generating an undesirable level of heat.

SUMMARY

According to an exemplary embodiment of the disclosure a saw assembly includes a housing, a motor, a first bevel gear, and a second bevel gear. The motor is located in the housing and includes a motor shaft configured for rotation relative to the housing. The first bevel gear is operably connected to the motor shaft for rotation with the motor shaft. The second bevel gear is operably engaged with the first bevel gear, such that rotation of the first bevel gear causes rotation of the second bevel gear. The arbor assembly is operably connected to the second bevel gear. The arbor assembly is accessible for mounting an accessory thereto from an accessory side of the housing and defines a first axis of rotation. The first bevel gear is located between the second bevel gear and the accessory side of the housing along the first axis of rotation.

According to another exemplary embodiment of the disclosure, a drivetrain for a power tool includes a motor, a first bevel gear, a second bevel gear, and an arbor assembly. The first bevel gear is operably connected to the motor for

rotation. The second bevel gear is operably engaged with the first bevel gear, such that rotation of the first bevel gear causes rotation of the second bevel gear. The arbor assembly is operably connected to the second bevel gear. The arbor assembly defines a first axis of rotation and includes an accessory end accessible for mounting an accessory thereto. The first bevel gear is located between the second bevel gear and the accessory end of the arbor assembly along the first axis of rotation.

BRIEF DESCRIPTION OF THE FIGURES

The above-described features and advantages, as well as others, should become more readily apparent to those of ordinary skill in the art by reference to the following detailed description and the accompanying figures in which:

FIG. **1** shows a perspective view of a first side of a saw assembly as described herein;

FIG. **2** shows a perspective view of an opposite side of the saw assembly of FIG. **1**;

FIG. **3** shows a cross sectional view taken along the line III-III of FIG. **1**;

FIG. **4** shows a portion of the cross sectional view of FIG. **3**;

FIG. **5** is a front perspective view of a portion of the saw assembly of FIG. **1**, showing a guard structure and a flat cutting wheel;

FIG. **6** is a front perspective view of a portion of the saw assembly of FIG. **1**, showing the guard structure and a flush cutting wheel;

FIG. **7** shows a front elevational view of the flat cutting wheel for use with the saw assembly of FIG. **1**;

FIG. **8** shows a side elevational view of the flat cutting wheel of FIG. **7**;

FIG. **9** shows a front perspective view of the flush cutting wheel for use with the saw assembly of FIG. **1**;

FIG. **10** shows a side elevational view of the flush cutting wheel of FIG. **9**;

FIG. **11** is a side elevational view of the saw assembly of FIG. **1** showing a lockout power switch;

FIG. **12** is a perspective view of a portion of the lockout power switch of FIG. **11**;

FIG. **13** is an exploded perspective view of a portion of the lockout power switch of FIG. **11**;

FIG. **14** is a cross sectional view of a portion of the saw assembly of FIG. **1**, showing the lockout power switch in a de-energized position;

FIG. **15** is a cross sectional view of a portion of the saw assembly of FIG. **1**, showing the lockout power switch in an energized position;

FIG. **16** is a cross sectional view of a portion of the saw assembly of FIG. **1**, showing a lock on structure for maintaining the lockout power switch in the energized position, the lock on structure is shown in a disengaged position;

FIG. **17** is a cross sectional view of a portion of the saw assembly of FIG. **1**, showing the lock on structure in an engaged position;

FIG. **18** is a side elevational view of a portion of the saw assembly of FIG. **1** showing the guard structure of the saw assembly and the flat cutting wheel;

FIG. **19** is a bottom plan view of the saw assembly of FIG. **1** showing the flush cutting wheel positioned in a protective pocket of the guard structure;

FIG. **20** is a side perspective view of the saw assembly of FIG. **1** showing the saw assembly part way through a workpiece cutting operation;

FIG. 21 is a side perspective view of a portion of the saw assembly of FIG. 1 showing a foot of the saw assembly in a position of maximum cutting depth and also showing a spring for biasing the foot;

FIG. 22 is a side perspective view of a portion of the saw assembly of FIG. 1 showing the foot of the saw assembly in the position of maximum cutting depth and also showing the spring for biasing the foot;

FIG. 23 is a side perspective view of a portion of the saw assembly of FIG. 1 showing the foot of the saw assembly in a position of minimum cutting depth and also showing the spring for biasing the foot;

FIG. 24 is a top perspective view of a portion of the saw assembly of FIG. 1 showing the spring of FIG. 21 as it is received by the foot;

FIG. 25 is a perspective view of a portion of the saw assembly showing an inlet dust port and an adapter;

FIG. 26 is a perspective view of a portion of the saw assembly of FIG. 1, the adapter, and a vacuum hose, additionally a schematic view of a vacuum source and a bin is also shown;

FIG. 27 is a perspective view of a portion of the saw assembly of FIG. 1 showing an inside surface of the dust port;

FIG. 28 is a perspective view of the adapter of FIG. 25;

FIG. 29 is a perspective view of a portion of saw assembly of FIG. 1, showing a portion of a base lock assembly;

FIG. 30 is a perspective view of a clamp component of the base lock assembly of FIG. 29;

FIG. 31 is a perspective view of a knob of the base lock assembly of FIG. 29;

FIG. 32 is a perspective view of a portion of the saw assembly of FIG. 1 showing another portion of the base lock assembly of FIG. 29;

FIG. 33 is a side elevational view of a portion of the saw assembly of FIG. 1 showing a depth gauge and also showing the foot in the position minimum cutting depth;

FIG. 34 is a top elevational view of a portion of the saw assembly of FIG. 1 having a T-square assembly attached thereto;

FIG. 35 is a bottom perspective view of a portion of the saw assembly of FIG. 1 and the T-square assembly of FIG. 34;

FIG. 36 is a top perspective view of the saw assembly of FIG. 1 and the T-square assembly of FIG. 34 part way though a workpiece cutting operation;

FIG. 37 shows a bottom perspective view of the saw assembly of FIG. 1 with a portion of a housing of the saw assembly removed to show a gear housing of the saw assembly;

FIG. 38 is a side elevational view showing the saw assembly of FIG. 1 connected to a table saw assembly;

FIG. 39 shows a top perspective view of a cutting guide for use with the saw assembly of FIG. 1;

FIG. 40 shows a top plan view of the cutting guide of FIG. 39;

FIG. 41 shows a bottom perspective view of the cutting guide of FIG. 39;

FIG. 42 shows a top perceptive view of the saw assembly of FIG. 1 and the cutting guide of FIG. 39, the saw assembly positioned to make a bevel cut through a workpiece;

FIG. 43 shows a bottom perspective view of the saw assembly of FIG. 1 and the cutting guide of FIG. 39, with the cutting wheel of the saw assembly extending through a cutting slot of the cutting guide;

FIG. 44 shows a top perspective view of a cutting guide for use with the saw assembly of FIG. 1;

FIG. 45 shows a top plan view of the cutting guide of FIG. 44;

FIG. 46 shows a bottom perspective view of the cutting guide of FIG. 44;

FIG. 47 shows a bottom plan view of the cutting guide of FIG. 44;

FIG. 48 shows a bottom perspective view of the foot of the saw assembly of FIG. 1 in isolation;

FIG. 49 shows a rear perspective view of the foot of the saw assembly of FIG. 1 in isolation;

FIG. 50 is a bottom perspective view of the saw assembly of FIG. 1 and the cutting guide of FIG. 39;

FIG. 51 is a perspective view of a deburring accessory for use with the saw assembly of FIG. 1;

FIG. 52 is a perspective view of the deburring accessory of FIG. 51 connected to the power saw of FIG. 1;

FIG. 53 is a top plan view of the deburring accessory of FIG. 51;

FIG. 54 is a cross sectional view taken along the line III-III of FIG. 53 showing the deburring accessory positioned to deburr a first pipe and a second pipe;

FIG. 55 is right side elevational view of another embodiment of the saw assembly of FIG. 1, the saw assembly of FIG. 55 includes a bevel gear drivetrain instead of the worm gear drivetrain of the saw assembly of FIG. 1;

FIG. 56 is left side elevational view of the saw assembly of FIG. 55;

FIG. 57 a side cross sectional view of the saw assembly of FIG. 55; and

FIG. 58 is a front cross sectional view of the saw assembly of FIG. 55.

DETAILED DESCRIPTION

For the purpose of promoting an understanding of the principles of the disclosure, reference will now be made to the embodiments illustrated in the drawings and described in the following written specification. It is understood that no limitation to the scope of the disclosure is thereby intended. It is further understood that the disclosure includes any alterations and modifications to the illustrated embodiments and includes further applications of the principles of the disclosure as would normally occur to one skilled in the art to which this disclosure pertains.

As shown in FIGS. 1 and 2, a saw assembly 100 includes a housing 104. The housing 104 includes a sleeve 108, a rearward housing portion 110 having an upper left shell 112 and an upper right shell 116, and a forward housing portion 118 having a lower left shell 120 and a lower right shell 124. The upper left shell 112 and the upper right shell 116 are connected to a rearward side of the sleeve 108, and the lower left shell 120 and the lower right shell 124 are connected to a forward side of the sleeve. Movement from the rearward housing portion 110 to the forward housing portion 118 is defined herein to be in the forward direction 126. While movement from the forward housing portion 118 to the rearward housing portion 110 is defined herein to be in the rearward direction 130. The housing 104 is formed from injection molded thermoplastic and defines an interior space 128 (FIG. 3) within the housing.

Worm Gear Drivetrain

As shown in FIG. 3, a drivetrain 132 is at least partially positioned within the interior space 128 defined by the housing 104. The drivetrain 132 includes an electric motor 136, a worm gear 140, a drive member 144, and an arbor assembly 148 (FIG. 1). The electric motor 136 is at least partially positioned within the interior space 128 and includes a stator **152** and a rotor **156**. The stator **152** is fixedly connected to the sleeve **108** of the housing **104** within the internal space **128**. The stator **152** generates a magnetic field within a rotor space **164**.

The rotor **156** includes a winding portion **168** and a motor shaft **172**. The winding portion **168** is fixedly connected to the motor shaft **172** and is positioned at least partially within the rotor space **164**. The motor shaft **172** is a generally cylindrical metal shaft, which extends from the rotor space **164** and is supported for rotation relative to the stator **152** and the housing **104** about a motor axis **176**. The rotor **156** and the motor shaft **172** rotate relative to the stator **152** and the housing **104** when the electric motor **136** is supplied with electrical energy.

With reference to FIG. **3**, the motor **136** is supplied with electrical energy through an electrical cord **178** extending through a rear housing opening **182**. It is noted that the forward direction **126** may also be defined herein as the path of movement from the electrical cord **178** toward the drive member **144**

As shown in FIG. **4**, the motor shaft **172** includes a set of external threads **180** and a smooth shaft portion **184** and defines a shoulder **188**. The external threads **180** are located on an end portion **192** of the motor shaft **172**. The smooth shaft portion **184** is located between the external threads **180** and the shoulder **188**. The smooth shaft portion **184** is a cylindrical portion of the motor shaft **172**.

The worm gear **140** is positioned in the internal space **128** of the housing **104** and, in particular, is positioned within a metal gear housing **196** (FIG. **3**). The worm gear **140** includes a set of worm gear teeth **200**, a bore structure **204**, and a worm gear shaft **208**. The bore structure **204** defines a blind bore **212** and an opening **216**, which leads to the blind bore. The bore structure **204** includes a set of internal threads **220** and a smooth bore portion **224**. The internal threads **220** are positioned within the blind bore **212** at a position that is spaced apart from the opening **216**. The internal threads **220** are configured to meshingly engage with the external threads **180** of the motor shaft **172** to connect the worm gear **140** to the motor shaft **172**.

The smooth bore portion **224** is positioned within the blind bore **212** between the internal threads **220** and the opening **216**.

With reference to FIG. **4**, the worm gear shaft **208** is coupled to the motor shaft **172**, such that rotation of the motor shaft causes rotation of the worm gear **140** about the motor axis **176**. In particular, the external threads **180** are located within the blind bore **212**, such that the external threads are meshingly engaged with the internal threads **220** to connect the worm gear **140** to the motor shaft **172**. As the external threads **180** are meshingly engaged with the internal threads **220**, the opening **216** is moved closer to the shoulder **188**. When the worm gear shaft **208** is coupled to the motor shaft **172**, the opening **216** is positioned adjacent to the shoulder **188**.

The smooth bore portion **224** of the bore structure **204** interacts with the smooth shaft portion **184** of the motor shaft **172** to accurately align the worm gear **140** with the motor shaft **172**. To this end, the smooth shaft portion **184** defines an outside diameter **222** and the smooth bore portion defines an inside diameter **226**. The outside diameter **222** and the inside diameter **226** are substantially equal (the outside diameter is slightly smaller than the inside diameter to allow entry of the motor shaft **172** into the bore **224**), such that the smooth shaft portion **184** fills the smooth bore portion **224** causing the worm gear **140** to become aligned with the motor shaft **172**.

As shown in FIG. **3**, the motor shaft **172** and the worm gear **140** are supported by a floating bearing **228**, a floating bearing **232**, and a floating bearing **236**. The floating bearing **236** supports a right end portion of the motor shaft **172**, the floating bearing **232** supports a left end portion of the motor shaft, and the floating bearing **228** supports a left end portion of the worm gear **140**.

As shown in FIG. **4**, the floating bearing **228** includes an inner race **240**, an outer race **244**, numerous ball bearings **248**, and an elastomeric support member **252**. The inner race **240** is fixedly connected to the worm gear **140** for rotation with the worm gear. The ball bearings **248** are positioned between the inner race **240** and the outer race **244**. The outer race **244** is received by the elastomeric support member **252**. The elastomeric support member **252** is received by the gear housing **196**. The inner race **240** is configured to rotate relative to the outer race **244** and the elastomeric support member **252** in response to rotation of the worm gear **140**. The floating bearing **232** and the floating bearing **236** are substantially identical, except that the inner races of the floating bearings **232**, **236** are fixedly connected to the motor shaft **172** and the elastomeric support of the floating bearing **236** is received by the housing **104**.

The floating bearing **228** is referred to as "floating" since the elastomeric support member **252** enables movement of the inner race **240** and the outer race **244** relative to the gear housing **196** and the housing **104**. Accordingly, the floating bearings **228**, **232**, **236** are suited to dampen vibrations of the motor shaft **172** and the worm gear **140**, which occur due to machine tolerances and other factors, which cause the motor shaft and the worm gear to be slightly unbalanced. The floating bearings **228**, **232**, **236** dampen these vibrations so that the saw assembly **100** is comfortable to hold during cutting operations.

With reference to FIG. **4**, the drive member **144** of the drivetrain **132** is operably coupled to the worm gear **140** and includes a pinion gear **256** and a driveshaft **260** both of which are at least partially positioned within the gear housing **196**. The pinion gear **256** includes a set of gear teeth **264** positioned to meshingly engage the worm gear teeth **200**. The driveshaft **260** is fixedly connected to the pinion gear **256**, such that rotation of the worm gear **140** results in movement of the driveshaft in a repeating pattern. Specifically, when the electric motor **136** is energized, rotation of the motor shaft **172** and the worm gear **140** results in rotation of the driveshaft **260** about an axis of rotation **268** (see FIG. **1**, extends into and out of the page in FIG. **4**), which is perpendicular to the motor axis **176** of the motor shaft **172**. The axis of rotation **268** and the motor axis **176** are not coincident. The motor axis **176** is perpendicular to a motor axis plane **272** and the axis of rotation **268** of the driveshaft **260** and the pinion gear **256** is perpendicular to a driveshaft plane **278** (not shown, parallel to a face **280** of the pinion gear **256**). The motor axis plane **272** is perpendicular to the driveshaft plane **278**. A portion of the driveshaft **260** extends through an opening **282** (FIG. **1**) in the lower right shell **124** of the forward housing portion **118**.

As shown in FIG. **5**, the arbor assembly **148** includes an arbor bolt **284**, a spacer **288** (also shown in FIG. **19**), and a washer **292**. The arbor bolt **284** extends through an opening (not shown) of the spacer **288**, an opening (not shown) of the washer **292**, and is threadingly received by a threaded opening (not shown) of the driveshaft **260**. As shown in FIG. **5**, the arbor assembly **148** connects a flat cutting wheel **296** to the saw assembly **100** for rotation with the driveshaft **260**.

As shown in FIG. **6**, the arbor assembly **148** connects a flush cutting wheel **300** to the saw assembly **100** for rotation with the driveshaft **260**.

As shown in FIGS. **7** and **8**, the flat cutting wheel **296**, which is also referred to herein as a flat cutoff wheel or a flat saw member, is generally circular and includes a flat hub portion **304** and a cutting structure **308**. The hub portion **304** defines an opening **312** in the center of the cutting wheel **296** through which the arbor bolt **284** extends when the cutting wheel is mounted to the driveshaft **260**. The cutting structure **308** is positioned on the periphery of the cutting wheel **296**. As shown in FIG. **8**, a plane **316** extends through the hub portion **304** and the cutting structure **308**. The cutting structure **308** is abrasive and is at least partially formed form carbide.

As shown in FIGS. **9** and **10**, the flush cutting wheel **300** is generally circular and includes a domed hub portion **320** and a cutting structure **324**. The domed hub portion **320** defines an opening **328** in the center of the cutting wheel **300** through which the arbor bolt **284** extends when the cutting wheel is mounted to the driveshaft **260**. The cutting structure **324** is positioned on the periphery of the cutting wheel **300**. A hub plane **332** extends through the hub portion **320**, and a cutting plane **336** extends through the cutting structure **324**. The hub plane **332** is parallel to the cutting plane **336** and is offset from the cutting plane, such that the cutting plane extends further from the arbor assembly **148** than does the plane **316** of the flat cutting wheel **296** when the cutting wheel **300** is mounted on the driveshaft **260**.

The cutting structure **308** of the cutting wheel **296** and the cutting structure **324** of the cutting wheel **300** each include numerous scallops **340**. The scallops **340** assist in removing debris from a kerf formed in a workpiece during cutting operations.

The cutting structure **308** and the cutting structure **324** differentiate the cutting wheel **296** and the cutting wheel **300** from traditional saw blades (not shown) that include cutting teeth. Accordingly, when one of the cutting wheels **296**, **300** is connected to the saw assembly **100**, the saw assembly may be referred to as a grinder or a circular saw. When a traditional saw blade is connected to the saw assembly **100**, the saw assembly may be referred to as a circular saw.

Lockout Power Switch

As in FIGS. **11**, **12**, and **13**, the saw assembly **100** includes a power lever **342** for operating a switch unit **394** (FIG. **14**) that couples electrical energy to the electric motor **136**.

The power lever **342** includes a trigger referred to herein as a paddle **344**, a lockout lever **346**, and a spring **348** (FIGS. **12** and **13**).

The paddle **344** includes a pivot structure **350** and an abutment structure **352** and defines a paddle cavity **354** and a contact surface **356**. The pivot structure **350** is positioned on an end portion of the paddle **344** and includes a barb **360**. The barb **360** of the pivot structure **350** is positioned within the interior space **128** defined by the housing **104**. Specifically, when the barb **360** is inserted into the housing **104** it interlocks with the housing to prevent the paddle **344** from being removed from the housing.

The paddle **344** pivots about the pivot structure **350** between an off position (also referred to herein as the de-energized position) (FIG. **14**) and an on position (also referred to herein as the energized position) (FIG. **15**) about a path of movement **362**. As shown in FIG. **11**, the paddle **344** at least partially extends through a housing opening **358** formed in both the sleeve **108** and the rearward housing portion **110**.

As shown in FIG. **14**, the abutment structure **352** is positioned on an opposite end portion of the paddle **344** and is at least partially positioned within the interior space **128** of the housing **104**. The abutment structure **352** includes a switch surface **364** located on a top side of the abutment structure and a catch feature or lock-on notch **366** located on a bottom/opposite side of the abutment structure. The switch surface **364** is positioned to engage an actuator **398** of a switch unit **394** of the saw assembly **100**. The lock-on notch **366** cooperates with a lock-on structure **402** of the saw assembly **100**, as described below.

With reference to FIG. **13**, the paddle cavity **354** is formed in the paddle **344** between the pivot structure **350** and the abutment structure **352** on an outer side of the paddle, which faces away from the electric motor **136**. The paddle cavity **354** defines a generally concave paddle cavity surface **372** (FIG. **15**). The paddle cavity **354** receives at least a portion of the lockout lever **346** and at least a portion of the spring **348**. The paddle cavity **354** has a length of approximately 2.5 centimeters (2.5 cm) and a width of approximately 2.0 centimeters (2.0 cm).

The paddle **344** includes an opening **368**, an opening **370**, and a lever opening **374** (FIGS. **14** and **15**). The opening **368** and the opening **370** are in fluid communication with the paddle cavity **354** and are used to pivotally connect the lockout lever **346** to the paddle, as described below. The lever opening **374** is formed in the cavity surface **372** and fluidly couples the interior space **128** to the paddle cavity **354**.

The contact surface **356** is at least a portion of the outer side of the paddle **344**. The contact surface **356** is a portion of the power lever **342** that a user contacts to use the power lever. The contact surface **356** is a convex surface such that fits comfortably in the hand of the user. The contact surface **356** has a width of approximately 2.3 centimeters (2.3 cm) and a length of approximately 6.0 centimeters (6.0 cm).

The lockout lever **346** includes a finger contact portion provided as an actuator portion **376**, a connection structure **378**, and a blocking member provided as a lockout tab **380**. The actuator portion **376** extends from the connection structure **378** and is generally semicircular in shape.

The connection structure **378** defines a pivot opening **382** for receiving a pivot shaft **384**. In particular, the pivot shaft **384** extends through the opening **368**, the pivot opening **382**, and the opening **370** to pivotally connect the lockout lever **346** to the paddle **344**. The lockout lever **346** extends through the lever opening **374** formed in the paddle **344** and into the interior space **128**. The lockout lever **346** pivots about the pivot shaft **384** between a lockout or locked position (FIG. **14**) and a non-lockout or an unlocked position (FIG. **15**).

The lockout tab **380** extends from the connection structure **378** and is at least partially positioned in the interior space **128**. The lockout tab **380** is positioned on a generally opposite side of the connection structure **378** from the actuator portion **376**. As shown in FIG. **14**, when the lockout lever **346** is in the locked position, the lockout tab **380** is positioned in a first location relative to the paddle **344** against a stop structure **386** of the housing **104**. As shown in FIG. **15**, however, when the lockout tab **380** is in the unlocked position, the lockout tab is moved to a second position relative to the paddle **344** away from the stop structure **386**.

With reference again to FIG. **13**, the spring **348** is a torsion spring, which includes a coil **388**, an arm **390**, and an arm **392**. The pivot shaft **384** extends through the coil **388** to position the arm **392** against the cavity surface **372** and the arm **390** against the actuator portion **376**. The spring **348** biases the lockout lever **346** toward the locked position as shown in FIG. **14**. In particular, the spring **348** biases the actuator portion **376** in the rearward direction **130** (FIG. **14**) and biases the lockout tab **380** in the forward direction **126** (FIG. **14**).

As shown in FIG. **14**, the switch unit **394** that is operated by the power lever **342** includes a switching element **396** and an actuator **398** positioned in the interior space **128** of the housing **104**. The actuator **398** is movable between an actuated position (FIG. **15**) and a deactuated position (FIG. **14**). When the actuator **398** is in the actuated position the switching element **396** couples electrical energy to the electric motor **136** and the electric motor operates to move the driveshaft **260** in the repeating pattern. When the actuator **398** is in the deactuated position the switching element **396** decouples electrical energy from the electric motor **136** and the motor does not operate to move the driveshaft **260** in the repeating pattern. The actuator **398** is spring biased in the deactuated position. The actuator **398** contacts the switch surface **364** of the paddle **344** to bias the paddle toward the de-energized position.

The power lever **342** prevents users from inadvertently energizing the electric motor **136**. As shown in FIG. **14**, the paddle **344** is in the de-energized position and the lockout lever **346** is in the locked position. When the lockout lever **346** is in the locked position, the lockout lever prevents the paddle **344** from being moved to the energized position due to physical interaction of the lockout tab **380** and the stop structure **386**. In particular, as shown in FIG. **14**, the lockout tab **380** is positioned against the stop structure **386** to prevent movement of the paddle **344**. Pivotal forces imparted on the paddle **344** which tend to move the abutment structure **352** toward the electric motor **136** about the path of movement **362**, wedge the lockout tab **380** against the stop structure **386** and the portion **400** of the paddle, such that no pivotal movement of the paddle occurs.

With reference to FIGS. **14** and **15**, when the lockout lever **346** is in the unlocked position movement of the paddle **344** to the energized position is enabled due to the lockout tab **380** being moved away from the stop structure **386**. Accordingly, to energize the electric motor **136**, first the lockout lever **346** is moved to the unlocked position and then the paddle **344** is pivoted to the energized position. The lockout lever **346** is pivoted to the unlocked position by moving the actuator portion **376** in the forward direction **126**. Pivoting of the lockout lever **346** is typically done by pressing the tip of the little finger against the actuator portion **376** and then squeezing the actuator portion against the cavity surface **372**. The forward direction **126** movement of the actuator portion **376** causes the lockout tab **380** to move in the rearward direction **130**.

The actuator **398** is moved to the energized position and the switch **394** energizes the electric motor **136** in response to the paddle **344** moving to the energized position. As shown in FIG. **15**, when the lockout lever **346** is in the unlocked position the lockout tab **380** is positioned behind the stop structure **386**, such that the lockout tab is misaligned with the stop structure and does not interfere with pivoting of the paddle **344**. The paddle **344** is moved to the energized position by squeezing the paddle. Typically, when moving the paddle **344** to the energized position, the fingers contact the contact surface **356** and the palm contacts an upper side of the sleeve **108**. The user moves the paddle **344** to energized position by initiating a squeezing movement of the hand, which causes the paddle to pivot about the pivot structure **350** and also causes the switch surface **364** to abut the actuator **398** and to move the actuator to the energized position. It is noted that the saw assembly **100** is configured for one hand operation; therefore, the same hand that moves the lockout lever **346** to the unlocked position is used to move the paddle to the energized position. The same hand is also used to guide the saw assembly **100** through the workpiece.

To return the paddle **344** to the de-energized position from the energized position the user releases the squeezing force on the paddle **344**. This causes the actuator **398** of the switch **394** to pivot the paddle **344** back to the de-energized position. When the paddle **344** is positioned in the de-energized position the actuator **398** is in the deactuated position and the motor **136** does not operate. Also, when the paddle **344** reaches or nearly reaches the de-actuated position, the torsion spring **348** returns the lockout lever **346** to the locked position.

The power lever **342** is positioned on the housing **104** in an ergonomic location. The power lever **342** is positioned to be easily contacted by the user's fingers on an underside of the sleeve **108**. Additionally, the force that the user applies to the saw assembly **100** to move the saw through a workpiece assists the user in maintaining the paddle **344** in the energized position.

As shown in FIGS. **16** and **17**, the saw assembly **100** also includes a lock-on member or structure **402**, which includes a slider **404** and a spring **406**. The slider **404** includes a push button portion **408** on a first end of the slider and a catch feature or a hook member **410** on an opposite second end of the slider. A flange **412** of the slider **404** is positioned between the push button **408** and the hook member **410**.

The slider **404** is at least partially positioned within the internal space **128**. In particular, the slider **404** is positioned in a slider cavity **414**. The slider cavity **414** includes a shoulder **416**, a shoulder **418**, and a button opening **420**. The slider **404** extends through the button opening **420**, such that the push button portion **408** is positioned outside of the internal space **128** and the hook portion **410** is positioned within the internal space.

The spring **406** is an extension spring positioned between the flange **412** of the and the shoulder **418**. The spring **406** biases the flange **412** against the shoulder **416**.

The slider **404** is movable between a non-interference position or disengaged positioned (FIG. **16**) and an interference position or an engaged position (FIG. **17**). As shown in FIG. **16**, the spring **406** biases the slider **404** in the disengaged position. As shown in FIG. **17**, the slider **404** is movable to the engaged position by moving the slider toward the paddle **344** against the biasing force of the spring **406**. When the slider **404** is in the engaged position, at least a portion of the slider is in the path of movement **362** of the paddle **344**. When the slider **404** is in the disengaged position the slider is spaced apart from the path of movement **362**.

The lock on structure **402** maintains the paddle **344** in the energized position without user intervention. To lock the paddle **344** in the energized position, first the paddle is moved to the energized position along the path of movement **362**. Then, with the paddle **344** in the energized position, the slider **404** is moved the engaged position. Thereafter, the squeezing force on the paddle **344** is released and the slider **404** maintains the paddle in the energized position. The paddle **344** is maintained in the energized position without user-contact of the power lever **342** or the push button **408**.

The hook portion **410** of the slider **404** engages the lock-on notch **366** to maintain the paddle **344** in the energized position. As shown in FIG. **17**, when the paddle **344** is in the energized position and the slider **404** is in the engaged position, the lock-on notch **366** is positioned above the hook portion **410**. Accordingly, when the force maintaining the paddle **344** in the energized position is released, the lock-on notch **366** becomes seated in the hook portion **410**, thereby preventing the paddle from returning to the de-energized position. The spring **406** supplies a biasing force that ensures the hook portion **410** and the lock-on notch **366** remain engaged without user intervention.

To release the paddle **344** from the lock-on structure, the switch surface **364** of the paddle **344** is moved slightly closer to the switching element **396** (not shown in FIGS. **16** and **17**), which moves the lock-on notch **366** away from the hook member **410** and disengages the lock-on notch from the hook member. When lock-on notch **366** and the hook member **410** are disengaged, the spring **406** returns the slider **404** to the disengaged position. Thereafter, the force on the paddle **344** may be released to allow the actuator **398** to return the paddle to the disengaged position.

Guard Structure

As shown in FIGS. **5** and **18**, the saw assembly **100** includes a guard assembly **422** in which one of the flat cutting wheel **296** and the flush cutting wheel **300** are partially positioned. The guard assembly **422** is secured to the housing **104** and includes a concave structure **424**, a partition **426**, and a flange **428**.

The concave structure **424** extends from a wall portion **430** (FIG. **18**) of the housing **104** and defines a protected space **432** for receiving at least a portion of one of the cutting wheel **296** and the cutting wheel **300**. The partition **426** is secured to the concave structure **424** within the protected space **432**. In particular, the partition **426** extends from the concave structure **424** toward the axis of rotation **268** (FIG. **5**). The flange **428** projects from the partition **426** in a direction parallel to the axis of rotation **268**. The wall portion **430**, the concave structure **424**, the partition **426**, the flange **428**, and the lower right shell **124** are integrally molded together in a monolithic part formed from injection molded thermoplastic.

As shown in FIG. **18**, the shape of the partition **426** is defined in relation to a workpiece contact plane **434** and an arbor plane **436**. The workpiece contact plane **434** is defined by a workpiece contact surface **466** (FIG. **19**) of a foot **456** (FIG. **19**) of the saw assembly **100**. As described in detail below, the workpiece contact surface **466** is positioned against and moved across a workpiece during cutting operations of the saw assembly **100**. The workpiece contact surface **466** is in the workpiece contact plane **434**. The axis of rotation **268** is parallel to the workpiece contact plane **434**.

The arbor plane **436** is parallel to the workpiece contact plane **434** and intersects the axis of rotation **268**. The arbor plane **436** also intersects a leading portion **438** and a trailing portion **440** of the partition **426**. The leading portion **438** is located forward of the axis of rotation **268** in relation to the forward direction **126** of movement of the saw assembly **100**. The arbor plane **436** intersects the leading portion **438** for an amount referred to as the leading intersection distance. The trailing portion **440** of the partition **426** is located behind the axis of rotation **268** in relation to the forward direction **126** of movement of the saw assembly **100**. The arbor plane **436** intersects the trailing portion **440** for an amount referred to as the trailing intersection distance. The leading intersection distance is less than the trailing intersection distance.

As shown in FIG. **19**, the partition **426** divides the protected space **432** into a cutting wheel space **442** and another cutting wheel space **444**. The cutting wheel space **442** is positioned on a side of the partition **426** nearest the wall portion **430**, such that the cutting wheel space **442** is interposed between the wall portion **430** and the partition **426**. The cutting wheel space **444** is positioned an opposite side of the partition **426** and is defined by the flange **428**.

With reference to FIG. **5**, the flange **428**, which is also referred to herein as a guard wall, defines a lateral guard wall surface **446** and a lower guard wall surface **448**. The lateral guard wall surface **446** is positioned against a workpiece or cutting guide during cutting operations that utilize the flush cutting wheel **300**. The lateral guard wall surface **446** is angled with respect to the lower guard wall surface **448** by approximately ninety degrees (90°). A bevel portion **450** of the lateral guard surface **446**/concave structure **424** is beveled with respect to the lower guard wall surface **448**.

The guard assembly **422** guards at least two types of cutting wheels including the flat cutting wheel **296** and the flush cutting wheel **300** without requiring any user configuration of the guard assembly when switching between the cutting wheels. As shown in FIG. **5**, the flat cutting wheel **296** is connected to the arbor assembly **148** and is at least partially positioned in the cutting wheel space **442** (FIG. **19**). When the electric motor **136** is supplied with electric energy the driveshaft **260** rotates the cutting wheel **296** about the axis of rotation **268** so that the cutting structure **308** is advanced through the cutting wheel space **442**.

As shown in FIG. **20**, the shape of the partition **426** enables a user of the saw assembly **100** to view a leading edge **452** of the cutting wheel **296** positioned in the cutting wheel space **442** as it moves through a workpiece W. For example, a cutting line **454** may be drawn on the workpiece W, representative of a desired cutting path. The shape of the partition **426** enables the user to view the point of intersection between the leading edge **452** and the cutting line **454** during the cutting operation. This simplifies the task of guiding the saw assembly **100** along a desired cutting line **454**.

As shown in FIG. **6**, the flush cutting wheel **300** is connected to the arbor assembly **148** and is at least partially positioned in the cutting wheel space **444** (FIG. **18**). When the electric motor **136** is supplied with electric energy the driveshaft **260** rotates the cutting wheel **300** about the axis of rotation **268** so that the cutting structure **324** is advanced through the cutting wheel space **444**.

Pivotable Foot

As shown in FIGS. **21** and **22**, the saw assembly **100** includes a foot **456** pivotally connected to the housing **104** and biased by a spring **457**. The foot **456** includes a base **458**, a hinge structure **460**, and an extension structure **462**, which are integrally molded together in a monolithic part formed from injection molded thermoplastic.

As shown in FIG. **21**, the base **458** defines an upper surface **464**, a workpiece contact surface **466**, and a cutting wheel passage **468**. The workpiece contact surface **466** is positioned against a workpiece W or a guide **780** (FIG. **39**) during cutting operations. The base **458** includes numerous grooves **470** (FIG. **19**) to reduce the surface area of the workpiece contact surface **466**, such that the workpiece contact surface slides easily on most workpieces.

As shown in FIG. **23**, the cutting wheel passage **468** is formed in the base **458** and is defined on three sides by the base. The passage **468** has a generally rectangular shape. The passage **468** is positioned on the side of the base **458** near the arbor assembly **148**, such that a portion of the cutting wheel **296**, **300** extends therethrough. The cutting wheel passage **468** may also be referred to herein as a base opening.

The hinge structure **460** includes a riser **472** extending from the base **458** and a conduit structure or a generally cylindrical member **474** extending from the riser. The riser **472** extends from the upper surface **464**. The cylindrical member **474** defines a central channel **476** that extends completely through the cylindrical member and which is defined by an opening **478** and an opening **480** (FIG. **22**). The cylindrical member **474** also defines a longitudinal axis **482**, which is parallel to the axis of rotation **268**. A left portion **484** (FIG. **22**) of the cylindrical member **474** is positioned on a left side of the riser **472**, and a right portion **486** (FIGS. **21** and **23**) of the cylindrical member is positioned on a right side of the riser.

The cylindrical member **474** of the hinge structure **460** is received by the housing **104** to enable the foot **456** to pivot relative to the housing or, stated differently, to enable the housing to pivot relative to the foot. In particular, as shown in FIG. **21**, the lower left shell **120** defines a hinge bore **488** or a hinge receptacle, and as shown in FIG. **22**, the lower right shell **124** defines a hinge bore **490** or a hinge receptacle. The hinge receptacles **488**, **490** have an inside diameter that is approximately equal to an outside diameter of the cylindrical member **474** to enable the hinge receptacle **488** to receive the left portion **484** and to enable the hinge receptacle **490** to receive the right portion **486**. The foot **456** is pivotable about the hinge structure **460** relative to the housing **104** about a pivot axis **492** that is coaxial with the longitudinal axis **482**. The foot **456** is shown in FIGS. **21** and **22** pivoted to a position of maximum cutting depth (also referred to as the non-rest position) and is shown in FIG. **23** pivoted to a position of minimum cutting depth (also referred to as the rest position).

As shown in FIG. **23**, the extension structure **462** includes a lower end portion **494** and an upper end portion **496** and defines an opening **498**. The lower end portion **494** is attached to the upper surface **464**. The extension structure **462** extends from the base **458** along a generally arcuate path into the interior space **128**, such that the upper end portion **496** is positioned in the interior space. The opening **498** is a generally arcuate opening that extends from near the lower end portion **494** to near the upper end portion **496**. The opening **498** cooperates with a base lock assembly **576** (FIG. **27**) for fixing the position of the foot **456** relative to the housing **104**.

As shown in FIG. **24**, the upper end portion **496** defines a spring arm contact surface **500** for contacting the spring **457** and includes a protrusion **502** and a protrusion **504**. The protrusion **502** extends from the upper end portion **496**, such that a portion of the protrusion **502** is positioned above the spring arm contact surface **500**. Similarly, the protrusion **504** extends for an approximately equal distance from the upper end portion **496**, such that a portion of the protrusion **504** is positioned above the spring arm contact surface **500**. The protrusion **502** is spaced apart from the protrusion **504** so as to define a gap **506** therebetween that is slightly wider than an arm **510** of the spring **457**.

With reference again to FIG. **21**, the spring **457** is a torsion spring, which includes a coiled portion **508**, an arm **510** connected to the coiled portion, and another arm **512** connected to the coiled portion. The coiled portion **508** is a generally circular coil including approximately three (3) coils of the wire used to form the spring **457**. The coil **508** defines a center axis **514**, and the spring **457** generates a resistive force when the arm **510** is pivoted about the center axis relative to the arm **512** (and vice versa).

The spring **457** is arranged in the interior space **128**. Specifically, the coil **508** is supported by a mount **516** extending from the left lower shell **120**. The mount **516** defines a generally circular periphery having a diameter that is slightly smaller than a diameter of the coil **508**, such that the mount extends through the coil.

As shown in FIG. **24**, the arm **510** is positioned on the spring contact surface **500** between the protrusion **502** and the second protrusion **504**. The protrusions **502**, **504** prevent the arm **510** from sliding off the spring contact surface **500** in the directions parallel to the axis **514**. A width **518** of the arm **510** is less than the gap **506**. Accordingly, the protrusions **502**, **504** enable the arm **510** to move relative to the spring contact surface **500** in the direction **520** and in the direction **522** in response to the movement of the foot **456**. The spring **457** includes an elbow **526** so that the arm **510** is in the proper position for being positioned on the spring contact surface **500**.

As shown in FIG. **23**, the arm **512** of the spring **457** is positioned against a stop tab **524** of the left lower shell **120**. The arm **512** remains in a generally fixed position in response to pivoting of the foot **456**.

The arm **510** of the spring **457** slides on the spring contact surface **500** during pivoting of the foot **456** relative to the housing **104**, which may alternatively be described as pivoting of the housing relative to the foot. The spring **457** biases the foot **456** toward the position of minimum cutting depth (FIG. **23**). In this position, an end **527** of the arm **510** is positioned adjacent to the protrusion **502**. As the foot **456** is pivoted to the position of maximum cutting depth (FIG. **21**) the spring arm **510** slides on the spring contact surface **500** such that the end **527** is separated from the protrusion **502** by the distance **525**. The arm **510** slides on the spring contact surface **500** as a result of the axis **514** being offset from the axis **482**. Additionally, pivoting the foot **456** from the position of minimum cutting depth (FIG. **23**) to the position of maximum cutting depth (FIG. **21**) causes at least a portion of the cutting wheel **296**, **300** to be advanced through the cutting wheel passage **468**.

Dust Port

As shown in FIGS. **25** and **26**, the saw assembly **100** includes a dust port assembly **528**, which includes a dust inlet or an inlet port **530**, a dust channel or central channel **476**, a dust outlet or an outlet port **534**, a coupling component or a connection structure **536**, and a hose adapter **538**. The inlet port **530** is a generally circular opening formed in the lower right shell **124**. The inlet port **530** is formed in the wall portion **430** and is in fluid communication with the hinge receptacle **490** (FIG. **22**). The inlet port **530** defines a center point and has a diameter of approximately eight millimeters (8 mm). The center point of the inlet portion **530** is aligned with the pivot axis **492** of the foot **456**. As shown in FIG. **20**, during a cutting operation the inlet port **530** is positioned near the point of intersection between the leading edge **452** of the cutting wheel **296**, **300** and the cutting line **454**. The inlet port **530** is aligned with the opening **478** and is juxtaposed with the protected spaced **432** defined by the flange **428**.

With reference to FIG. **21**, the dust channel is provided as the central channel **476** in the cylindrical member **474** of the hinge structure **460**. The dust channel **476**, which may also be referred to as a conduit passage, is a bore that extends from the opening **478** on a first side of the cylindrical member **474** to the opening **480** (FIG. **22**) on an opposite end of the cylindrical member. The dust channel **476** is a generally cylindrical channel that defines the longitudinal axis **482** (FIG. **22**), which is coaxial with the pivot axis **492** (FIG. **22**) of the foot **456**.

As shown in FIG. **27**, the outlet port **534** is an opening formed in the lower left shell **120**. The outlet port **534** is in fluid communication with the hinge receptacle **488** (FIG. **21**). The outlet port **534** is also in fluid communication with the opening **480**, the dust channel **476**, the opening **478**, and the inlet port **530**. The outlet port **534** is a generally circular port that defines a center point that is aligned with the pivot axis of the foot **456** (FIG. **22**).

The connection structure **536** is formed in the lower left shell **120** and defines a receptacle or a circular bore **540** that is concentric with the outlet port **534**. The connection structure **536** also includes numerous friction ribs **542** and a wall **544**. The friction ribs **542** extend radially inward from the circular bore **540** for approximately one millimeter (1 mm). The friction ribs **542** are generally evenly spaced around the periphery of the circular bore **540**. The wall **544** terminates the circular bore **540**.

As shown in FIG. **28**, the adapter **538** includes a coupling component or inlet structure **546**, a funnel portion **548**, and an outlet structure **550**. The adapter **538** is formed from injection molded thermoplastic. The inlet structure **546** is a generally cylindrical structure defining a central opening **552** and an adapter passage **554**. The outside diameter of the inlet structure **546** is approximately equal to an inside diameter of the circular bore **540**, such that the inlet structure is configured to mate with the connection structure **536** to secure the adapter **538** to the housing **104**. When the inlet structure **546** is mated with the connection structure **536**, the adapter passage **554** is in fluid communication with the outlet port **534**. The outlet structure **550** is also a generally cylindrical structure defining a central opening **556** and an outlet passage **558**.

The funnel portion **548** fluidly connects the adapter passage **554** of the inlet structure **546** to the outlet passage **558** of the outlet structure **550**. To this end, the funnel portion defines a dust channel (not shown) that is narrowest near the inlet structure **546** and that is widest near the outlet structure **550**. The funnel portion **548** defines an elbow **562**, such that the inlet structure **546** is offset from the outlet structure **550**.

As shown in FIG. **26**, the dust port assembly **528** is used with a vacuum hose/tube **564**, a vacuum source **566**, and a collection bin **568** to draw dust generated by the cutting wheel **296**, **300** to the collection bin. To use the dust port assembly **528**, first the adapter **538** is connected to the saw assembly **100** by inserting the inlet structure **546** into the bore **540** until the inlet structure contacts the bottom wall **544**. The exterior of the inlet structure **546** contacts the friction ribs **542** when it is inserted into the connection structure **536**, such that a friction fit is established between the connection structure and the inlet structure. Due to the friction fit, the adapter **538** remains in a fixed position relative to the connection structure **536** without user intervention. Nonetheless, the adapter **538** is easily rotated about the pivot axis **492** to a desired position. Next, the vacuum tube **564** is connected to the outlet structure **550** of the adapter **538**. The vacuum tube **564** includes a fitting **570** that frictionally fits within the outlet structure **558**. To connect the vacuum tube **564** to the adapter **538** the fitting **570** is inserted within the outlet structure **558**.

Thereafter, the vacuum source **566** is energized and a workpiece W is cut with the cutting wheel **296**, **300**. As the cutting wheel **296**, **300** moves through the workpiece W dust and debris is generated at a point near the inlet port **530**. Accordingly, when the vacuum source **566** is activated air and the dust and debris are drawn into the inlet port **530**, through the dust channel **476**, through the adapter passage **554**, through the dust channel **560**, through the outlet passage **558**, through a hose passage **572** of the vacuum hose **564**, and into the collection bin **568**.

Base Lock Assembly

As shown in FIGS. **22** and **29**, the saw assembly **100** includes a base lock assembly **576** having a clamp component **578** (FIG. **29**) and a clamp actuator **580** (FIG. **22**). With reference to FIG. **29**, the clamp component **578** includes a clamping surface **582** and a bore structure **584** (shown in phantom). The clamping surface **582** is a portion of the gear housing **196** that surrounds the bore structure **584**. The clamping surface **582** is generally flat and defines a plane that is perpendicular to the workpiece contact plane **434**. The clamping surface **582** is positioned within the interior space **128**.

The bore structure **584** is formed in the gear housing **196**. The bore structure **584** defines a longitudinal axis **586** that is parallel to the axis of rotation **268**. The bore structure **584** includes a plurality of internal threads **588** (shown in phantom). The internal threads **588** are left-handed threads.

The clamp actuator **580** includes a clamp component **590** (FIG. **29**) and a knob **592** (FIG. **22**). With reference to FIG. **30**, the clamp component **590** includes a post **594**, a drive structure **596**, and a clamping surface **598**. The clamp component **590** is formed from metal. In other embodiments, however, the clamp component **590** is formed from injection molded thermoplastic or another hard material.

The post **594** is generally cylindrical and includes a threaded portion **600** and a smooth portion **602**. The post **594** is approximately seventeen millimeters (17 mm) in length. The threaded portion **600** includes a set of external threads **605** and has a length of approximately ten millimeters (10 mm). The external threads **605** are "left-handed" threads that are sized to mesh with the internal threads **588** of the bore structure **584**. The smooth portion **602** is positioned between the threaded portion **600** and the drive structure **596**. The smooth portion **602** is generally cylindrical and has a length of approximately six millimeters (6 mm) and a diameter of approximately six millimeters (6 mm).

The drive structure **596** is positioned on an end of the clamp component **590** that is opposite the threaded portion **600**. The drive structure **596** includes an exterior polygonal-shaped surface, which has six sides and can be driven by an eight millimeter (8 mm) wrench/spanner. The drive structure **596** has width that is wider than a width of the post **594** and a length of approximately nine millimeters (9 mm). The drive structure **596** defines an internally threaded bore **604** centered about a longitudinal axis **586** of the clamp component **590**. The threaded bore **604** includes a set of "right-handed" internal threads **606**.

The clamping surface **598** is positioned at the junction of the drive structure **596** and the post **594** and is defined by an end surface of the drive structure. The clamping surface **598** defines a plane that is parallel to the plane defined by the clamping surface **582**.

As shown in FIG. **31**, the knob **592** includes a hub **608**, a lever **610**, and a tab **612** each of which is integrally formed from injection molded thermoplastic. The hub **608** includes a drive structure **614** and an opening **616**. The drive structure **614** is correspondingly sized and shaped to mate with the drive structure **596**. In particular, the drive structure **614** includes an interior polygonal-shaped surface that mates with the exterior polygonal-shaped surface of the drive structure **596**.

The opening **616** extends through the hub **608** and is centered about the longitudinal axis **586** of the clamp component **590**. A fastener **618** (FIG. **27**) extends through the opening **616** and into the threaded bore **604** to connect the knob **592** to the clamp component **590**. When the drive structure **614** is mated with the drive structure **596**, rotation of the knob **592** results in rotation of the clamp component **590**.

The lever **610** extends from a first side of the hub **608**. The lever **610** defines a push surface **620** and a push surface **622**. The push surfaces **620**, **622** are contacted when rotation of the lever **610** is desired.

The tab **612** extends from a side of the hub **608** opposite the lever **610**. The tab **612**, which may also be referred to herein as a limiter, includes a contact surface **624** on one side of the tab and a contact surface **626** on an opposite side of the tab.

As shown in FIG. **32**, when the clamping structure **590** is threadingly received by the bore structure **584**, the extension structure **462** extends between the clamping surface **582** and the clamping surface **598**. The extension structure **462** remains positioned between the clamping surface **582** and the clamping surface **598** during pivoting of the foot **456** relative to the housing **104**

The clamp actuator **580** is rotatable between a first actuator position (an unclamped position) and a second actuator position (a clamped position). When the clamp actuator **580** is in the unclamped position the clamping surface **582** is spaced apart from the clamping surface **598** by an open distance. The open distance is greater than a width **628** of the extension structure **462**, such that the extension structure is able to advance between the clamping surface **582** and the clamping surface **598** when the clamp actuator **580** is in the unclamped position. In the unclamped position the base **458** is pivotal about pivot axis **492** relative to the housing **104**.

When the clamp actuator **580** is rotated counterclockwise to the clamped position, the clamping surface **598** advances toward the clamping surface **582**. In particular, in the clamped position the clamping surface **598** is separated from the clamping surface **582** by a closed distance. The closed distance is less than the open distance and is approximately equal to the width **628** of the extension arm **462**. The closed distance positions the clamping surface **598** and the clamping surface **582**, such that the extension structure **462** is clamped between the clamping surface **598** and the clamping surface **582** so that pivoting of the base **458** relative to the housing **104** is inhibited.

As shown in FIG. **27**, the housing **104** includes a limiter **630** that is positioned to interact with the tab **612** of the base lock assembly **576**. In particular, the housing **104** includes a limiter **630** extending from an exterior surface of the lower left shell **120**. The limiter **630** includes an arcuate structure **632** attached to the exterior surface. The arcuate structure **632** includes a contact surface **634** at one end and a contact surface **636** at the opposite end. If the arcuate structure **632** were extended to form a circle, a center point of the circle would be aligned with the longitudinal axis **586** of the clamp component **590**.

The limiter **630** interacts with the tab **612** to prevent the clamp actuator **580** from being rotated beyond the clamped position and from being rotated beyond the unclamped position. In particular, rotation of the clamp actuator **580** in the clockwise direction (as viewed in FIG. **27**) is prevented by physical interaction (i.e. contact) between the contact surface **624** of the tab **612** and the contact surface **634** of the limiter **630**. Likewise, rotation of the clamp actuator **580** in the counterclockwise direction (as viewed in FIG. **27**) is prevented by physical interaction (i.e. contact) between the contact surface **626** of the tab **612** and the contact surface **636** of the limiter **630**.

The limiter **630** and the tab **612** prevent the clamp actuator **580** from becoming over tightened and under tightened. In particular, interaction between the contact surface **624** and the contact surface **634** prevents the clamp actuator **580** from being rotated to a position in which the clamp component **590** becomes separated from the bore structure **584**. In this way, the clamp actuator **580** does not become lost or separated from the saw assembly **100**. Additionally, the interaction between the contact surface **626** and the contact surface **636** ensures that the when these two surfaces **626**, **636** meet the clamp actuator **580** applies a consistent clamping force to the extension structure **462**. The consistent clamping force is one that has been determined to fix the pivotal position of the base **458** securely over the life of the saw assembly **100**. Accordingly, the limiter **630** and the tab **612** prevents the clamp actuator **580** from being rotated to a rotational position that applies a damaging clamping force to the extension structure **462**. The damaging clamping force deforms the extension structure **462** so that it does not pivot about the pivot axis **492** effectively.

Depth Gauge

As shown in FIG. **27**, the saw assembly **100** includes a depth gauge assembly **640**, which includes an indicator projection **642** (FIG. **32**), an indicator opening **644**, a first depth gauge portion **646**, and a second gauge portion **648**. With reference to the foot **456**, as shown in

FIG. **32**, the indictor projection **642** includes an arm **650** and a marker **652**. The arm **650** extends from the upper end portion **496** of the extension structure **462**. The marker **652** extends from the arm **650** in a direction parallel to the pivot axis **492**.

Referring again to FIG. **27**, the opening **644** is formed in the lower left shell **120** of the housing **104**. The opening **644** has a generally arcuate shape of approximately the same radius as the opening **498** in the extension structure **462**. The marker **652** is positioned to extend through the opening **644**. The position of the marker **652** within the opening **644** depends on the position of the foot **456** relative to the housing **104**. In particular, when the foot **456** is in the position of minimum cutting depth (FIG. **33**) the marker **652** is positioned at the bottom of the opening **644**, and when the foot **456** is in the position of maximum cutting depth (FIG. **27**) the marker **652** is positioned at the top of the opening **644**.

The depth gauge portion **646** is positioned on a first side of the opening **644** and includes indicia denoting ⅛ inch, ¼ inch, ½ inch, and ¾ inch cutting depths. The depth gauge portion **648** is positioned on the second side of the opening **644** and includes indicia denoting 0 mm, 5 mm, 10 mm, 15 mm, and 20 mm cutting depths. Both the depth gauge portion **646** and the depth gauge portion **648** are integrally formed into the lower left shell **120**.

The depth gauge assembly **640** is used to indicate the distance that the cutting wheel **296**, **300** extends below the workpiece contact surface **466**. For example, the foot **456** may be moved relative to the housing **104** until the marker **652** is aligned with a desired cutting depth as shown on the depth gauge portion **646** or the depth gauge portion **648**. When the desired cutting depth is achieved, the foot **456** is locked in position relative to the housing **104** with the base lock assembly **576**.

T-Square Accessory

As shown in FIGS. **34** to **36**, a T-square **660** may be used with the saw assembly **100**. The T-square **660** includes a guide member **662** connected to a positioning rod **664** with a connector **666**. The guide member **662** includes a body **668**, a guide structure **670**, and numerous support ribs **672**. The body **668** is a generally flat member from which the guide structure **670** extends. The support ribs **672** are positioned to contact the body **668** and the guide structure **670**, thereby increasing the rigidity of the guide member **662**. The body **668**, the guide structure **670**, and the support ribs **672** are integrally molded together in a monolithic part formed from injection molded thermoplastic.

As shown in FIG. **35**, the guide structure **670** defines a generally flat guide surface **674**. The guide surface **674** is positioned against a workpiece W (see FIG. **36**) when the T-square **660** is in use. The guide surface **674** is generally rectangular and has a length of approximately fifteen centimeters (15 cm) and a height of approximately two centimeters (2 cm). The guide surface **674** is free from protrusions or other irregularities that may interfere or prohibit sliding of the guide member **662** against the workpiece W.

The body **668** further defines a rod pocket **676** and a rod pocket **678**. The rod pocket **676** defines an opening **680** in the guide structure **670** and an opening **682** in the body **668**. The second rod pocket **678** defines an opening **684** in the guide structure **670** and a connector opening (not shown), which is substantially identical to the opening **682**.

The positioning rod **664** is a generally straight rod having a generally rectangular cross section. The positioning rod **664** has a length of approximately 25 centimeters (25 cm), a width of approximately 1 centimeter (1 cm) and a thickness of approximately 0.3 centimeters (0.3 cm). The positioning rod **664** defines a threaded opening **686**. Another threaded opening is positioned on the opposite end of the positioning rod **664**, but is not visible since it is shown having received a portion of the connector **666**. The positioning rod **664** is sized to extend through the opening **680** and the opening **684**. The positioning rod **664** is formed from metal.

As shown in FIG. **35**, the positioning rod **664** is received by the base **458**. To this end, the base **458** defines a rod channel **688** (FIG. **3**) and includes a connecting structure **690**. The rod channel **688** has a length that is parallel to the axis of rotation **268**.

The connecting structure **690** includes a fastener **692** and a clamp member provided as a square nut **694**. The fastener **692** is threadingly received by the square nut **694**. The connecting structure **690** is positioned within a clamp pocket **696** formed in the base **458**.

The clamp pocket **696** is fluidly connected to the rod channel **688**, such that the fastener **692** is at least partially positionable within the rod channel.

The connector **666** includes a fastener **698** extending from a handle **700**. The fastener **698** is sized to be threadingly received by the opening **686** in the positioning rod **664**. The handle **700** is fixedly connected to the fastener **698**.

As shown in FIG. **35**, the T-square **660** is assembled and connected to the base **458** by inserting an end portion of the positioning rod **664** into the rod pocket **678**. The rod pocket **678** is positioned such that when the positioning rod **664** is received therein, the positioning rod extends from the guide structure **670** in a direction that is perpendicular to the guide surface **674**. Next, the connector **666** is used to connect the positioning rod **664** to the guide member **662**. Thereafter, the positioning rod **664** is inserted into the rod channel **688** until the guide surface **674** is a predetermined distance from the cutting wheel **296**. Thereafter, the fastener **698** is advanced into the rod channel **688** to fix the position of the positioning rod **664**.

As shown in FIG. **36**, with the T-square **660** connected to the saw assembly **100** a user may make rip cuts in a workpiece W along a desired cut path **702**. In particular, to use the T-square **660** the guide surface **674** is positioned against an edge E of the workpiece W. Then the saw assembly **100** is energized and moved along the cut path **702** to advance the cutting wheel **296** through the workpiece W. By maintaining the guide surface **674** against the edge E, the cutting wheel **296** is advanced through the workpiece W by the predetermined distance from the edge E.

Attachment Structures

As shown in FIGS. **29** and **37**, the gear housing **196** includes an attachment bore **750** and an attachment bore **752**. The attachment bore **750** defines a longitudinal axis **754** that is parallel to the axis of rotation **268**. The attachment bore **750** includes a plurality of internal threads. As shown in FIG. **33**, the lower left shell **120**, defines a circular opening **756** having a center point positioned in alignment with the longitudinal axis **754**.

As shown in FIG. **37**, the attachment bore **752** is also formed in the gear housing **196**. The attachment bore **752** includes a plurality of internal threads. As shown in FIG. **19**, the base **458** defines an opening **758** that is positioned in alignment with the attachment bore **752** when the foot **456** is in the position of the maximum cutting depth. When the foot **456** is moved to positions other than the position of maximum cutting depth, the opening **758** is not positioned in alignment with the attachment bore **752**. Both the attachment bore **750** and the attachment bore **752** have the same internal thread count/structure.

The attachment bore **750** and the attachment bore **752** are used to connect accessories (not shown) to the saw assembly **100** or to connect the saw assembly **100** to an accessory element. For example, a handle (not shown) having a shaft with a threaded tip may be threadingly received by the attachment bore **750** by inserting the shaft through the opening **756** and into the attachment bore.

As shown in FIG. **38**, for example, the attachment bore **752** may be used to connect the saw assembly **100** to a table saw assembly **760**. The table saw assembly **760** includes a table **762** defining a countersunk bore **764** and a cutting wheel opening (not shown). The saw assembly **100** is connected to the table **762** by first positioning the foot **456** in the position of maximum cutting depth. Next, a fastening member **766** is inserted through the bore **764** in the table **762**, through the opening **758** in the base **458**, and into the threaded bore **752**. With the saw assembly **100** connected to the table **762**, the cutting wheel **296** (not shown in FIG. **38**) extends through the cutting wheel opening and is positioned above a workpiece support surface **768** of the table **762**. The saw assembly **100** and table saw assembly **760** are used to cut workpieces W in a manner similar to table saws known to those of ordinary skill in the art.

Miter Cutting Guide Accessory

As shown in FIGS. **39** and **40**, a cutting guide **780** is provided for use with the saw assembly **100**. The cutting guide **780** includes a guide structure **782** and a guide structure **784**. The cutting guide **780** is formed from injection molded thermoplastic. The guide structure **782** is provided as a bevel cutting guide. The guide structure **784** is provided as a miter cutting guide.

The guide structure **782** includes a saw support **786** and a saw support **788**, both of which are attached to a base **790**. The saw support **786** defines a saw contact surface **792**, a step structure **794**, and a step structure **796**. The saw contact surface **792** is a generally flat surface that is positioned in a plane.

The step structure **794** is offset from the saw contact surface **792** and is positioned at a first end of the saw support **786**. The step structure **796** is also offset from the saw contact surface **792** and is positioned at an opposite end of the saw support **786**. The saw contact surface **792** extends between the step structure **794** and the step structure **796**. The step structure **794** and the step structure **796** each define a contact surface **798**, **800** that is positioned perpendicular to the plane defined by the saw contact surface **792**.

The saw support **788** defines another saw contact surface **802**. The saw contact surface **802** is a generally flat surface that is positioned in a plane. The plane defined by the saw contact surface **792** intersects the plane defined by the saw contact surface **802** to define an angle of intersection having a magnitude of ninety degrees (90°). In other embodiments, the angle of intersection has a magnitude greater than eighty degrees (80°) and less than one hundred degrees) (100°).

The saw contact surface **802** is spaced apart from the saw contact surface **792** so as to define a window or an elongated cutting slot **804** therebetween. The cutting slot **804** is oriented along a slot axis **806** and includes a first slot portion **808**, a second slot portion **810**, and a third slot portion **812**. The second slot portion **810** is contiguous with the first slot portion **808** and the third slot portion **812**. The second slot portion **810** is interposed between the first slot portion **808** and the third slot portion **812**.

As shown in FIG. **41**, the base **790** of the guide structure **782** defines a first cavity **814** positioned below the cutting slot **804**. The first cavity **814** includes a first workpiece space **816**, a first cutting member start space **818** positioned on a first side of the first workpiece space **816**, and a first cutting member end space **820** positioned on an opposite second side of the first workpiece space **816**. The first workpiece space **816** is positioned below the second slot portion **810** and receives a workpiece W to be cut by the saw assembly **100** during a cutting operation. The first cutting member start space **818** is positioned below the first slot portion **808** and is where the cutting wheel **300** is positioned at the beginning of the cutting operation. The first cutting member end space **820** is positioned below the third slot space **812** and is where the cutting wheel **300** is positioned at the end of the cutting operation.

The base **790** of the guide structure **782** includes a first sidewall **822**, a second sidewall **824**, and end wall **826**, and an end wall **828**. The first sidewall **822** and the second sidewall **824** are positioned generally parallel to each other. The end wall **826** extends between the first sidewall **822** and the second sidewall **824** at an end portion of the guide structure **782**. The end wall **828** is positioned at an opposite end portion of the guide structure **782** and extends between the first sidewall **822** and the second sidewall **824**.

As shown in FIG. **41**, the base **790** of the guide structure **782** defines the first workpiece space **816**. Specifically, the workpiece space **816** defined by a first workpiece passage **830** and a second workpiece passage **832**. The first workpiece passage **830** is formed in the first sidewall **822** and is defined by a first lateral passage surface **834** that is spaced apart from a second lateral passage surface **836**. The second workpiece passage **832** is formed in the second sidewall **824** and is defined by a third lateral passage surface **838** that is spaced apart from a fourth lateral passage surface **840**. The first workpiece passage **830** is spaced apart from the second workpiece passage **832** so as to define the first workpiece space **816** therebetween.

The guide structure **782** further includes a guide wall **844** to assist in positioning the cutting guide **780** on a workpiece W. The guide wall **844** is positioned in the cavity **814** and defines a first guide surface portion **846**. The guide surface portion **846** is positioned under the cutting slot **804**. The guide surface portion **846** and the first lateral passage surface **834** are positioned in a plane that includes both surfaces. The slot axis **806** (FIG. **40**) is perpendicular to the plane in which the first lateral passage **834** and the guide surface portion **846** are positioned.

As shown in FIG. **40**, the saw support **786** defines a cutout **848** in the saw contact surface **792**. The cutout **848** is contiguous with the cutting slot **804**. The guide surface portion **846** is positioned under the cutout **848** so that visualization of the guide surface portion is enhanced.

As shown in FIG. **39**, the base **790** includes a reference indicia mark **842** positioned on the first sidewall adjacent the first lateral passage surface. The reference indicia mark **842** indicates a pivot point for use with the guide structure **784**, as described below.

As shown in FIG. **41**, the saw support **786** also defines a first workpiece contact surface **850** and a second workpiece contact surface **852**. The first workpiece contact surface **850** is an underside portion of the saw support **786** and is generally parallel to the cutting slot **804**. The second workpiece contact surface **852** is an underside portion of the saw support **788** and is generally parallel to the cutting slot **804**. The workpiece contact surface **850** and the workpiece contact surface **852** are positioned in the cavity **814**. It is noted that the cutting slot **804** may be defined by the first workpiece contact surface **850** being spaced apart from the second workpiece contact surface **852**.

With reference to FIG. **39**, the guide structure **784** extends from the guide structure **782** and includes a first guide wall **854**, a second guide wall **856**, and numerous support ribs **858** that extend between the first guide wall and the second guide wall. The first guide wall **854** extends from the base **790** and defines a first guide surface **860**. The first guide wall **854** includes a leg **862** (FIG. **41**) attached the base **790**. The leg **862** supports the guide structure **784** during use of the cutting guide **780**.

The second guide wall **856** extends from the base **790** and defines a second guide surface **864**. The second guide wall **856** extends perpendicularly from the second sidewall **856** of the base **790**. The second guide wall **856** intersects the first guide wall **854** to define a corner **866**.

The second guide wall **856** includes a leg **868** and a leg **870** (FIG. **41**). The leg **868** extends downwardly from the second guide wall **856** and, in particular, extends downwardly from the corner **866**. The leg **870** extends downwardly from the second guide wall **856**. The leg **868** and the leg **870** are spaced apart to define a third workpiece passage **872**. The leg **868** and the leg **862** are spaced apart to define a fourth workpiece passage **874**.

The first guide wall **854** and the second guide wall **856** form an angle having a magnitude between thirty degrees (30°) and sixty degrees (60°). The angle between the first guide wall **854** and the second guide wall **856** is forty five degrees (45°). The angle between the first guide wall **854** and the second guide wall **856** is used to make miter cuts in the workpiece W at the angle. The guide structure **784** includes numerous reference indicia **876** (FIG. **40**) and magnitudes formed on the first guide wall **854**, the second guide wall **856**, and the ribs **858**. The second indicia **876** are used to position the guide structure **784** when making cuts that are different than the angle between the first guide wall **856** and the second guide wall **856**.

The guide structure **784** further includes a clamp structure **878** extending from the second guide wall **856**. The clamp structure **878** includes a flat clamp surface **880** and numerous support ribs **882**. The clamp structure **878** receives a clamping force, which connects the cutting guide **780** to a workpiece W. The flat clamp surface **880** typically contacts a clamp member and the support ribs **882** increase the structural integrity of the cutting guide **780** so that it is not deformed or otherwise damage as a result of the clamping force.

As shown in FIG. **41**, the guide structure **784** includes a second workpiece space **884** that receives a workpiece W. The second workpiece space **884** is defined by the third workpiece passage **872** and the fourth workpiece passage **874**. The second workpiece space **884** is aligned with the first workpiece space **816**, such that a workpiece W extending through the first workpiece passage **830** extends through the first workpiece space and the second workpiece space.

As shown in FIGS. **42** and **43**, in operation, the cutting guide **780** is used to make bevel cuts and miter cuts on a workpiece W with the saw assembly **100** being equipped with the flush cutting wheel **300**. The guide structure **782** is used to make a bevel cut. First, the workpiece W is positioned in the workpiece space **816**. The workpiece W is positioned against the first lateral passage surface **834**, the guide wall **844**, the leg **868**, the first workpiece contact surface **850**, and the second workpiece contact surface **852**. This arrangement positions the cutting slot **804** perpendicularly to the edge E of the workpiece W.

Next, the user "fine tunes" the position of the cutting guide **780** on the workpiece W. To do this, the user looks through the cutout **848** and locates first guide surface portion **846**. The guide surface portion **846** is positioned a predetermined distance from the desired cutting path through the workpiece W. Accordingly, the position of the cutting guide **780** is adjusted until the guide surface portion **846** is the predetermined distance from the desired cutting path. Thereafter, a clamp (not shown) is affixed to the clamp structure **878** and the workpiece W to prevent further movement of the cutting guide **780** relative to the workpiece.

The user next positions the saw assembly **100** on the cutting guide **780** with the workpiece contact surface **466** of the foot **456** positioned against the first saw contact surface **792** and with the flange **428** positioned against the second saw contact surface **802**. The first guide structure **782** supports the saw assembly **100** on two sides to ensure that the saw assembly is maintained at the proper bevel angle for the duration of the cut.

As shown in FIG. **43**, the flush cutting wheel **300** extends though the cutting slot **804** into the cutting member start space **818** of the cavity **814**. The start space **818** of the cavity **814** provides the user with a region in which the saw assembly **100** can be energized to bring the cutting wheel **300** up to full rotational speed without the cutting wheel being in contact with the workpiece W. After the saw assembly **100** is energized the saw assembly **100** is moved toward the end wall **828** through the workpiece to cut the workpiece at a bevel angle of forty five degrees (45°).

The saw assembly **100** is moved toward the end wall **828** with the workpiece contact surface **466** positioned against the first saw contact surface **792** until the leading sidewall **886** of the foot **456** contacts the step structure **794**, which is positioned to stop any additional forward movement of the saw assembly **100**. At this point the cutting operation is complete and the user may release the paddle **344** to deenergize the electric motor **136**. It is noted that the step structure **796** stops movement of the saw assembly **100** in the reward direction by contacting a trailing sidewall **888** of the base **458**.

The guide structure **784** is used to make miter cuts with the saw assembly **100**. To prepare the saw assembly **100** to make miter cuts the user typically connects the flat cutting wheel **296** to the arbor assembly **148**; although, the flush cutting wheel **300** is also usable. Next, the cutting guide **780** is positioned on the workpiece W. In particular, the workpiece W is positioned against the guide wall **844** and the leg **868** in the first workpiece space **816** and the second workpiece space **884**. Next the flange **428** is positioned against the first guide surface **860**. Thereafter, the rotating cutting wheel **296** is moved through the workpiece with the flange **428** being maintained against the first guide surface **860**.

In the above configuration, the first guide surface **860** is positioned to make a forty five degree (45°) miter cut through the workpiece. The cutting guide **780** is pivotable about the first lateral passage surface **834** to a desired cutting angle as indicated by the indicia **876**.

Crown Molding Cutting Guide

As shown in FIGS. **44** to **47**, a cutting guide **900** is provided for use with the saw assembly **100**. The cutting guide **900** includes a first guide structure **902** connected to a second guide structure **904** by an intermediate part **906**. The cutting guide **900** is formed from injection molded thermoplastic.

As shown in FIG. **44**, the first guide structure **902** includes a first saw support **908** and a second saw support **910**, both of which are attached to a base **912**. The first saw support **908** defines a first saw contact surface **914**, a first step structure **916**, and a second step structure **918**. The first saw contact surface **914** is a generally flat surface that is positioned in a plane.

The first step structure **916** is offset from the first saw contact surface **914** and is positioned at a first end of the first saw support **908**. The second step structure **918** is also offset from the first saw contact surface **914** and is positioned at an opposite second end of the first saw support **908**. The first step structure **916** and the second step structure **918** each define a contact surface **920**, **922** that is positioned perpendicular to the plane defined by the first saw contact surface **914**.

The second saw support **910** defines a second saw contact surface **924**. The second saw contact **924** surface is a generally flat surface that is positioned in a plane. The plane defined by the first saw contact surface **914** intersects the plane defined by the second saw contact surface **924** to define an angle of intersection θ**1** having a magnitude of ninety degrees (90°). In other embodiments, the angle of intersection θ**1** has a magnitude greater than eighty degrees (80°) and less than one hundred degrees (100°).

As shown in FIG. **45**, the second saw contact surface **924** is spaced apart from the first saw contact surface **914** to as to define a first elongated cutting slot **926** therebetween. The cutting slot **926** is oriented along a slot axis **928** and includes a first slot portion **930**, a second slot portion **932**, and a third slot portion **934**. The second slot portion **932** is contiguous with the first slot portion **930** and the third slot portion **934**. The second slot portion **932** is interposed between the first slot portion **930** and the third slot portion **934**.

With reference to FIG. **47**, the base **912** of the first guide structure **902** defines a first cavity **936** positioned below the cutting slot **926**. The first cavity **936** includes a first workpiece space **938**, a first cutting member start space **940** positioned on a first side of the first workpiece space, and a first cutting member end space **942** positioned on an opposite second side of the first workpiece space. The first workpiece space **938** is positioned below the second slot portion **932** and receives a workpiece W to be cut by the saw assembly **100** during a cutting operation. The first cutting member start space **940** is positioned below the first slot portion **930** and is where the cutting wheel **300** is positioned at the beginning of the cutting operation. The first cutting member end space **942** is positioned below the third slot portion **934** and is where the cutting wheel **300** is positioned at the end of the cutting operation.

The base **912** of the first guide structure **902** includes a first sidewall **944**, a second sidewall **946**, an end wall **948**, and a common end wall **950**. The first sidewall **944** and the second sidewall **946** are positioned generally parallel to each other. The first end wall **948** extends between the first sidewall **944** and the second sidewall **946**. The common end wall **950** is positioned at a guide end portion of the first guide structure **902** and extends between the first sidewall **944** and the second sidewall **946** and also the sidewalls of the guide structure **904**.

As shown in FIG. **46**, the base **912** of the first guide structure **902** defines the first workpiece space **938**. The workpiece space **938** is defined by a first workpiece passage **952** and a second workpiece passage **954**. The first workpiece passage **952** is formed in the first sidewall **944** and is defined by a first passage surface **956** that is spaced apart from a second passage surface **958**. The second workpiece passage **954** is formed in the second sidewall **946** and is defined by a third passage surface **960** that is spaced apart from a fourth passage surface **962**. The first workpiece passage **952** is spaced apart from the second workpiece passage **954** so as to define the first workpiece space **938** therebetween.

As shown in FIG. **47**, the first guide structure **902** includes a first guide wall **964** and a second guide wall **966** to assist in positioning the cutting guide **900** on a workpiece W. The first guide wall **964** is positioned in the cavity **936** and defines a first guide surface portion **968**. The second guide wall **966** is positioned in the cavity **936** and defines a second guide surface portion **970**. The first guide surface portion **968** and the second guide surface portion **970** are positioned under the cutting slot **926**.

As shown in FIG. **45**, the first saw support **908** defines a first cutout **972** and a second cutout **974** in the first saw contact surface **914**. The first cutout **972** and the second cutout **974** are each contiguous with the cutting slot **926**. The guide surface portion **968** is positioned under the first cutout **974** so that visualization of the first guide surface portion is enhanced. The guide surface portion **970** is positioned under the second cutout **972** so that visualization of the second guide surface portion is enhanced.

With reference to FIG. **47**, the first guide structure **902** also defines a first workpiece contact surface **976** and a second workpiece contact surface **978**. The first workpiece contact surface **976** is an underside portion of the saw support **910** that is generally parallel to the cutting slot **926**. The second workpiece contact surface **978** is an underside portion of the saw support **908** that is generally parallel to the cutting slot **926**. The workpiece contact surface **976** and the workpiece contact surface **978** are positioned in the cavity **936**.

The guide structure **904** is substantially identical to the guide structure **902**. However, for completeness the guide structure **904** is described in detail. The guide structure **904** includes a saw support **980** and a saw support **982**, both of which are attached to a base **984**. The first saw support **980** defines a first saw contact surface **986**, a first step structure **988**, and a second step structure **990**.

The second saw support **982** of the guide structure **904** defines a second saw contact surface **992**. The plane defined by the first saw contact surface **986** intersects the plane defined by the second saw contact surface **992** to define an angle of intersection **02** having a magnitude of ninety degrees (90°). In other embodiments, the angle of intersection θ2 has a magnitude greater than eighty degrees (80°)and less than one hundred degrees (100°).

The second saw contact surface **992** is spaced apart from the first saw contact surface **986** so as to define a cutting slot **994** therebetween. The cutting slot **994** is oriented along a slot axis **995** and includes a first slot portion **996**, a second slot portion **998**, and a third slot portion **1000**. The slot axis **995** and the slot axis **928** intersect at an acute angle θ (FIG. **44**). The acute angle θ has a magnitude that is greater than forty five degrees (45°)and less than seventy five degrees (75°).

As shown in FIGS. **46** and **47**, the base **984** of the guide structure **904** defines a cavity **1002** positioned below the cutting slot **994**. The cavity **1002** includes a workpiece space **1004**, a cutting member start space **1006** positioned on a first side of the first workpiece space **1004**, and a first cutting member end space **1008** positioned on an opposite second side of the first workpiece space **1004**. The first workpiece space **1004** is positioned below the second slot portion **998** and receives a workpiece W to be cut by the saw assembly **100** during a cutting operation. The first cutting member start space **1006** is positioned below the first slot portion **996** and is where the cutting wheel **300** is positioned at the beginning of the cutting operation. The first cutting member end space **1008** is positioned below the third slot space **1000** and is where the cutting wheel **300** is positioned at the end of the cutting operation.

The base **984** of guide structure **904** includes first sidewall **1010**, a second sidewall **1012**, and end wall **1014**, and the common sidewall/end wall **950**. The first sidewall **1010** and the second sidewall **1012** are positioned generally parallel to each other. The first end wall **1014** extends between the first sidewall **1010** and the second sidewall **1012**. The common end wall **950** is positioned at a guide end portion of the first guide structure **902** and extends between the first sidewall **1010**, the second sidewall **1012**, and the also the sidewalls **944**, **946** of the other guide structure **902**.

As shown in FIG. **46**, the base **984** of the guide structure **904** defines the workpiece space **1004**. The workpiece space **1004** is defined by a first workpiece passage **1018** and a second workpiece passage **1020**. The first workpiece passage **1018** is formed in the first sidewall **1010** and is defined by a first passage surface **1022** that is spaced apart from a second passage surface **1024**. The second workpiece passage **1020** is formed in the second sidewall **1012** and is defined by a third passage surface **1026** that is spaced apart from a fourth passage surface **1028**. The first workpiece passage **1018** is spaced apart from the second workpiece passage **1020** so as to define the workpiece space **1004** therebetween.

The guide structure **904** includes the guide wall **964** and the guide wall **966** to assist in positioning the cutting guide **900** on a workpiece. The first guide wall **964** is positioned in the cavity **1002** and defines a first guide surface portion **1034**. The first guide surface portion **1034** is positioned under the cutting slot **994**. The passage surface **956**, the passage surface **1022**, the guide surface portion **968**, and the guide surface portion **1034** lie in a plane **1038**. The second guide wall **966** is positioned in the cavity **1002** and defines a second guide surface portion **1036**. The second guide surface portion **1036** is positioned under the cutting slot **994**. The passage surface **958**, the passage surface **1024**, the guide surface portion **970**, and the guide surface portion **1036** all lie in a second plane **1040** that is parallel to the plane **1038**.

The saw support **980** defines a cutout **1042** and a cutout **1044** in the first saw contact surface **986**. The cutout **1042** and the cutout **1044** are each contiguous with the cutting slot **994**. The guide surface portion **1036** is positioned under the cutout **1042** so that visualization of the guide surface portion **1036** is enhanced. The guide surface portion **1034** is positioned under the cutout **1044** so that visualization of the guide surface portion **1034** is enhanced.

The guide structure **904** also defines a first workpiece contact surface **1046** and a second workpiece contact surface **1048**. The first workpiece contact surface **1046** is an underside portion of the saw support **980** that is generally parallel to the cutting slot **994**. The second workpiece contact surface **1048** is an underside portion of the saw support **982** that is generally parallel to the cutting slot **994**. The workpiece contact surface **1046** and the workpiece contact surface **1048** are positioned in the cavity **1002**.

The intermediate part **906** is positioned between first guide structure **902** and the second guide structure **904**. The intermediate part **906** is connected to the sidewall **946** and the sidewall **1012** and fixes the position of the guide structure **902** relative to the guide structure **904**. An interguide space **1050** is defined below the intermediate part **906**. Since the guide structure **902** is spaced apart from the guide structure **904** a space exists therebetween and is referred to as the interguide space **1050**.

The intermediate part **906** includes a first abutment structure **1052** and a second abutment structure **1054**. The first abutment structure **1052** is located in the cavity **1002**, the interguide space **1050**, and the cavity **936**. Accordingly, the abutment structure **1052** is positioned under both the cutting slot **926** and the cutting slot **994**. The abutment structure **1052** defines an abutment surface **1056** against which a workpiece is positioned during cutting operations. The abutment structure **1052** includes the guide wall portion **970** and the guide wall portion **1036**. The passage surface **958**, the passage surface **1024**, and the abutment surface **1056** lie in the plane **1040**.

The abutment structure **1054** is located in the cavity **936**, the interguide space **1050**, and the cavity **1002**. Accordingly, the abutment structure **1054** is positioned under both the cutting slot **926** and the cutting slot **994**. The abutment structure **1054** defines an abutment surface **1058** against which a workpiece is positioned during cutting operations. The abutment structure **1054** includes the guide wall portion **968** and the guide wall portion **1034**. The passage surface **956**, the passage surface **1022**, and the abutment surface **1058** lie in the plane **1038**.

The intermediate part **906** further includes a clamp structure **1060** including a flat clamp surface **1062** and numerous support ribs **1064** The clamp structure **1060** receives a clamping force, which connects the cutting guide **900** to the workpiece. The support ribs **1064** increase the structural integrity of the cutting guide **900** so that it is not deformed or otherwise damaged as a result of the clamping force.

In operation, the cutting guide **900** is used to guide the cutting wheel **300** of the saw assembly **100** through a workpiece. Specifically, the cutting guide **900** is used to make a compound miter cut in a workpiece. A compound miter cut is a cut that is beveled and mitered. These type of cuts are frequency performed when cutting sections of crown molding to be joined at an inside or an outside corner of the room.

To make a cut with the cutting guide **900** the workpiece is positioned in one or more of the workpiece space **938** and the workpiece space **1004**. An edge of the workpiece is positioned against one or more of the abutment surface **1056** and the abutment surface **1058**. The cutting guide **900** is moved along the workpiece until the desired line of cut is aligned with the one of the guide surface portions **968**, **970**, **1034**, **1036** which are visible through the cutouts **972**, **974**, **1042**, **1044**. Depending on the desired cutting orientation a face of the workpiece may be positioned against or away from the workpiece contact surfaces **976**, **978**, **1046**, **1048**. Also, the saw assembly **100** should be equipped with the flush cutting wheel **300** when being used with the cutting guide **900**. After the cutting guide **900** has been aligned, a cutting operation is performed in same manner as is performed with the bevel guide structure **782** described above.

Features of the Foot Related to Miter Cutting Guide and Crown Molding Cutting Guide

The foot **456** of the saw assembly **100** is suited for operation with the miter cutting guide **780** and the crown molding cutting guide **900**. As shown in FIGS. **48** and **49**, the base **458** of the foot **456** includes a main portion **1110**, a first cantilevered portion **1112**, and a second cantilevered portion **1114**. The main portion **1110** includes an upper base surface **1116**, a lower base surface **1118**, and a lateral sidewall surface **1120**. The lower base surface **1118** is positioned against the saw contact surface **792** during cutting operations in which the cutting guide **780** is used. The lateral sidewall **1120** surface extends between the lower base surface **1118** and the upper base surface **1116**.

The first cantilevered portion **1112** extends laterally from the main portion **1110** and terminates to define a leading surface **1122** of the lateral sidewall surface **1120**. The leading surface **1122** is beveled with respect to the lower base surface **1118**. The second cantilevered portion **1114** also extends laterally from the main portion **1110** and terminates to define a trailing surface **1124** of the lateral sidewall surface **1120**. The trailing surface **1124** is also beveled with respect to the lower base surface **1118**. The first cantilevered portion **1112** and the second cantilevered portion **1114** are spaced apart from each other to define the cutting member opening or cutting wheel passage **468**.

As shown in FIG. **49**, when the base **458** is viewed in a cross section the leading surface **1122** and the lower base surface **1118** define an angle **1126** of approximately one hundred thirty five degrees (135°). Similarly, when the base **458** is viewed in cross section the trailing surface **1124** and the lower base surface **1118** define an angle **1128** of approximately one hundred thirty five degrees (135°). In another embodiment of the foot **456**, the angle defined by the leading surface **1122** and lower base surface **1118** and the angle defined by the trailing surface **1124** and the lower base surface **1118** may be greater than one hundred twenty degrees (120°) and less than one hundred fifty degrees (150°).

As shown in FIG. **50**, the above-described structure of the foot **456** prevents any portion of the foot from extending below the cutting slot **804** during cutting operations in which the cutting guide **780** and the cutting guide **900** are utilized. If the foot **456** were to extend below the cutting slot **804** and into the cavity **814**, the foot would abut the workpiece W as the user attempts to slide the saw assembly **100** toward workpiece, thereby preventing cutting of the workpiece. Accordingly, the foot **456** enables the flush cutting wheel

300 to extend through the cutting slot 804, while preventing the base 458 from extending through the cutting slot (i.e. the base is spaced apart from the cutting slot) when the lower base surface 1118 is positioned in contact with the saw contact surface 792 (FIG. 39) and the flange 428 is positioned in contact with the saw contact surface 802 (FIG. 39).

Additionally, as described above with respect to the guard assembly 422, the beveled surface 450 of the guard ensures that the guard is spaced apart from the cutting slot 804 and ensures that no portion of the guard assembly 422 extends through the cutting slot where it could abut the workpiece and interfere with a cutting operation.

Deburring Accessory

As shown in FIGS. 51 to 54, the saw assembly 100 is includes a fastener assembly or a deburring accessory 1150. The deburring accessory 1150 includes a fastener structure or support structure 1152 and an abrasive member or abrasive element 1154. As shown in FIG. 54, the support structure 1152 includes a post or a shaft 1156, a platform or a shoulder 1158, and a drive portion or a head 1160. The support structure 1152 is formed from metal. In another embodiment of the deburring accessory 1150, the support structure 1152 is formed from hard plastic.

The shaft 1156 includes a threaded portion 1162 and an unthreaded portion 1164. The threaded portion 1162 includes a set of external threads sized to be threadingly received by the opening 1167 (FIG. 37) in the driveshaft 260 of the arbor assembly 148 to connect the deburring accessory 1150 to the saw assembly 100. The unthreaded portion 1164 extends from the threaded portion 1162.

The shoulder 1158 extends from the unthreaded portion 1164 and from the head 1160. The shoulder 1158 includes a lower clamping surface or a lower seat 1166 that is positioned against the cutting wheel 296, an upper support surface or an upper seat 1168 that supports the abrasive element 1154, and a washer recess 1170. The shoulder 1158 defines a generally circular periphery and has a diameter of approximately twenty one millimeters (21 mm). The upper seat 1168 extends from the head 1160 for approximately six millimeters (6.0 mm). The washer recess 1170 is defined in the shoulder 1158 and is located adjacent to the lower seat 1166. The washer recess 1170 extends around the shaft 1156.

As shown in FIG. 53, the head 1160 extends from the shoulder 1158 and the unthreaded portion 1164. The head 1160 defines a generally circular periphery and has a diameter of approximately nine millimeters (9.0 mm). The head 1160 defines a tool opening or a recess 1172 having a drive surface. The recess 1172 is polygonal-shaped and is configured to receive a fastening tool, such as a hex key (not shown).

The abrasive element 1154 is connected to the head 1160 and the shoulder 1158. The abrasive element 1154 includes a grinding stone 1174 defining an interior surface 1176 and a central passage 1178, a lower surface 1180, and an exterior side surface having a tapered exterior surface portion 1182. The abrasive element 1154 is secured to the support structure 1152 so that the head 1160 is located within the central passage 1178. In particular, the interior surface 1176 is secured to an exterior side surface of the drive portion and the lower surface 1180 is secured to the upper seat 1168.

As shown in FIG. 51, the tapered exterior surface 1182 is a generally conical deburring surface. At the bottom of the deburring surface (nearest the shoulder 1158) the abrasive element has a width of approximately twenty one millimeters (21 mm). At the top of the deburring surface (positioned furthest from the shoulder 1158) the abrasive element 1157 has a width of approximately thirteen millimeters (13.0 mm).

The grinding stone 1174 of the abrasive element is formed from aluminum oxide. Specifically, the abrasive element may be provided as the aluminum oxide as provided in the Dremel 952 Aluminum Oxide Grinding Stone manufactured by the Robert Bosch Tool Corporation. In an alternative embodiment of the deburring accessory 1150, the abrasive element 1154 is formed from silicon carbide, such as the silicon carbide as provided in the Dremel 84922 Silicon Carbide Grinding Stone manufactured by the Robert Bosch Tool Corporation. In yet another alternative embodiment of the deburring accessory 1150 the abrasive element 1154 is formed from industrial diamonds, any alumina-based abrasive, cubic boron nitride ("CBN"), and the like.

The deburring accessory 1150 is used to secure the cutting wheel 296 to the saw assembly 100 in place of the arbor bolt 284 (FIG. 1) and the washer 292 (FIG. 1). The threaded portion 1162 is threaded into the opening 1167 in the driveshaft 260. When the deburring accessory 1150 is tightened onto the driveshaft 260, the cutting wheel 296 is clamped between the lower surface 1180 and the spacer 288 (FIG. 1) for rotation with the driveshaft.

After securing the deburring accessory 1150 and the cutting wheel 296 to the driveshaft 260, the saw assembly is used to perform a cutting operation on a pipe or other tubular structure. As a result of the cutting operation a burr 1184 (FIG. 54) is formed on the cut edge of the pipe.

After performing the cutting operating, the deburring accessory 1150 is used to remove the burr 1184 without requiring any changes or configuration of the saw assembly 100. The abrasive element 1154 of the deburring accessory 1150 is used to smooth the cut edge of a pipe, tube, or conduit that has been cut by the cutting wheel 296. Specifically, the abrasive element 1154 is used to remove the burr or ridge formed on the cut end of the pipe after the pipe is cut with the cutting wheel. To use the abrasive element 1154, the rotating conical deburring surface 1182 is urged against the burr or ridge to wear away the bun or ridge.

As shown in FIG. 54, the conical shape of the abrasive element 1154 uniformly removes the bun or ridge from the inside edge of the pipe P1, P2. The conical deburring surface 1182 is positionable against the inside edge of a pipe having an inside diameter that is greater than the diameter of the top of the deburring surface and that is less than the diameter of the bottom of the deburring surface. The pipe P1 has an inside diameter of approximately one half inch (0.5 in), and the pipe P2 has an inside diameter of approximately the three quarters of one inch (0.75 in). The abrasive element 1154 uniformly removes the burr 1184 or ridge since the conical deburring surface 1182 contacts most or all of the inside edge of the pipe at the same time.

In addition to being usable with the saw assembly 100, the deburring accessory 1150 is also usable with other saw assemblies, grinders, and power cutting tools. For example, the deburring accessory 1150 is usable with circular saws and grinders that are typically used to cut metal pipe/conduit. Additionally, the deburring accessory 1150 is usable with, for example, portable band saws, which are typically used to cut metal pipe/conduit.

In another embodiment of the deburring accessory 1150, the head 1160 and the shaft 1156 are connected together and are separate from the shoulder 1158 and the abrasive member 1154. In this embodiment, the head 1160 and the shaft 1156 are provided as a separate bolt (not shown) that is similar to the arbor bolt 284 (FIG. 1). The shoulder 1158 defines an opening having a diameter larger than a diameter of the shaft **1156**, but smaller than the diameter/width of the head **1160** so that the head is positioned against the shoulder when the deburring accessory **1150** is connected to the saw assembly **100**.

Bevel Gear Drivetrain

As shown in FIGS. **55-58**, another embodiment of a saw assembly **1200** is substantially the same as the saw assembly **100** except that the saw assembly **1200** includes a bevel gear drivetrain **1204** instead of a worm gear drivetrain **132** (FIG. **3**).

With reference to FIGS. **57** and **58**, the bevel gear drivetrain **1204** includes a motor **1208** (FIG. **57**), a pinion bevel gear **1212**, a driven bevel gear **1216**, an arbor assembly **1220**, a left roller bearing member **1224** (FIG. **58**), a thrust bearing member **1230** (FIG. **58**), and a right roller bearing member **1228** (FIG. **58**). The motor **1208** is located in a housing **1232** of the saw assembly **1200** and includes a motor shaft **1236** (FIG. **57**) configured for rotation relative to the housing **1232**.

With reference to FIG. **57**, the pinion bevel gear **1212**, which is also referred to herein as a first bevel gear, is operably connected to the motor shaft **1236** for rotation with the motor shaft about an axis of rotation **1240**. In one embodiment, a fastener member **1238** (FIG. **57**) is threadingly engaged with the motor shaft **1236**, and the pinion bevel gear **1212** is fixed in position between the fastener member **1238** and a shoulder **1242** (FIG. **57**) of the motor shaft. In another embodiment, the pinion bevel gear **1212** is threadingly engaged with the motor shaft **1236**. In yet another embodiment, the pinion bevel gear **1212** is connected to the motor shaft **1236** using any desired process, such as being press-fit onto the motor shaft, for example.

The driven bevel gear **1216**, which is also referred to herein as a second bevel gear, is operably engaged with the pinion bevel gear **1212**, such that rotation of the pinion bevel gear results in rotation of the driven bevel gear. The driven bevel gear **1216** defines a plurality of gear teeth **1244** (FIG. **57**) that are meshingly engaged with a plurality of gear teeth **1248** (FIG. **57**) defined by the pinion bevel gear **1212**. In one embodiment, the driven bevel gear **1216** includes more gear teeth **1244** than the pinion bevel gear **1212** such that the driven bevel gear rotates slower than the pinion bevel gear for a given rotational speed (i.e. angular velocity) of the pinion bevel gear.

As shown in FIG. **58**, the arbor assembly **1220** is operably connected to the driven bevel gear **1216**. In particular, the arbor assembly **1220** is fixedly connected to the driven bevel **1216**, such that rotation of the driven bevel gear **1216** results in rotation of the arbor assembly **1220** about an axis of rotation **1252** that is substantially perpendicular to the axis of rotation **1240** (FIG. **57**) of the pinion bevel gear **1212**. The driven bevel gear **1216** may be press-fit onto the arbor assembly **1220** or connected to the arbor assembly **1220** according to any desired process.

The arbor assembly **1220** defines an accessory end **1256**, a bearing end **1260**, and a lock opening **1264**. The arbor assembly **1220** is rotatably supported within the housing **1232** and is intersected by the axis of rotation **1240** of the pinion bevel gear **1212** between the driven bevel gear **1216** and the accessory side **1268** of the housing **1232**.

The accessory end **1256** is accessible outside of an accessory side **1268** of the housing **1232** for mounting an accessory, such as one of the cutting wheels **296** (FIG. **58**), to the arbor assembly **1220**. An arbor bolt **1272**, a washer **1276**, and a spacer **1280** are connected to the accessory end **1256** of the arbor assembly **1220** for securing the cutting wheel **296** thereto.

The bearing end **1260** of the arbor assembly **1220** is opposite from the accessory end **1256** along the axis of rotation **1252**. The bearing end **1260** is positioned adjacent to a bearing side **1284** of the housing **1232**, which is opposite from the accessory side **1268** along the axis of rotation **1252**. The bearing end **1260** is at least partially positioned in a bearing recess **1288** that is defined by the housing **1232**.

The lock opening **1264** extends completely through the arbor assembly **1220** and is configured to receive a lock pin **1292** that is movably supported by the housing **1232**. When the lock pin **1292** is moved into the lock opening **1264**, rotation of the arbor assembly **1220** is prevented, and when the lock pin is spaced apart from the arbor assembly (as shown in FIGS. **57** and **58**) rotation of the arbor assembly is enabled.

With continued reference to FIG. **58**, the thrust bearing member **1230**, which is also referred to herein as a third bearing member, is at least partially positioned in the bearing recess **1288** of the housing **1232**. The bearing end **1260** of the arbor assembly **1220** is positioned against the thrust bearing member **1230**, which is configured to axially support the arbor assembly **1220** and to limit axial movement of the arbor assembly along the axis of rotation **1252**. In one embodiment, the thrust bearing member **1230** is provided as washer-like element positioned in the bearing recess **1288**. In another embodiment, the thrust bearing member **1230** is provided as any desired bearing member.

The left roller bearing member **1224**, which is also referred to herein as a first bearing member, is at least partially positioned in the bearing recess **1288** of the housing **1232**. The left roller bearing member **1224** is configured to receive the bearing end **1260** of the arbor assembly **1220** and to rotatably support the arbor assembly **1220**. The left roller bearing member **1224** enables rotational movement of the arbor assembly **1220** about the axis of rotation **1252**. The left roller bearing member **1224** may be provided as any desired bearing member.

The right roller bearing member **1228**, which is also referred to herein as a second bearing member, is supported by the housing **1232** and is configured to rotatably support the arbor assembly **1220**. The right roller bearing member **1228** is located between the accessory side **1268** of the housing **1232** and the pinion bevel gear **1212** along the axis of rotation **1252**. The right roller bearing member **1228** enables rotational movement of the arbor assembly **1220** about the axis of rotation **1252**. The right roller bearing member **1228** is provided as any desired bearing member.

In operation, the bevel drivetrain **1204** is a compact assembly that efficiently transmits torque generated by the motor **1208** to the arbor assembly **1220** and the cutting wheel **296** connected thereto. Specifically, the bevel drivetrain **1204** causes the arbor assembly **1220** to rotate the cutting wheel **296** in a clockwise direction **1296** (FIG. **57**). The clockwise direction **1296** of rotation of the arbor assembly **1220** enables the cutting wheel **296** to cut a workpiece with a push motion, which most users are accustomed to. Additionally, the bevel gears **1212**, **1216** are a type of drivetrain that transmits torque from the motor **1208** to the arbor assembly **1220** without generating an undesirable level of heat. Therefore, the drivetrain **1204** is compact, efficient, and durable.

Furthermore, the location of the bevel gears **1212**, **1216** and the bearing members **1224**, **1228**, **1230** within the housing **1232** provides some advantages when the cutting wheel **296** is subject to an axial load directed toward the housing (i.e. to the left in FIG. **58**). As shown in FIG. **58**, the driven bevel gear **1216** is positioned between the thrust bearing member **1230** and the pinion bevel gear **1212** along the axis of rotation **1252** of the arbor assembly **1220**.

Additionally, the pinion bevel gear **1212** is located between the driven bevel gear **1216** and the accessory side **1268** of the housing **1232**, the accessory end **1256** of the arbor assembly **1220**, and the right roller bearing member **1228** along the axis of rotation **1252** of the arbor assembly. Accordingly, if an axial load is imparted on the arbor assembly **1220** toward the housing **1232**, as may occur if an axial load is applied to the cutting wheel **296**, the driven bevel gear **1216** tends to move away from the pinion bevel gear **1212** and imparts the axial load on the housing **1232** through the thrust bearing member **1230**. Thus, the axial load does not pass through the pinion bevel gear **1212** and the motor shaft **1236**, thereby preventing stress upon the motor **1208** and ultimately extending the usable life of the saw assembly **1200**.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, the same should be considered as illustrative and not restrictive in character. It is understood that only the preferred embodiments have been presented and that all changes, modifications and further applications that come within the spirit of the disclosure are desired to be protected.

What is claimed is:

1. A saw assembly, comprising:

a housing;

a motor located in the housing and including a motor shaft configured for rotation relative to the housing;

a first bevel gear operably connected to the motor shaft for rotation with the motor shaft;

a second bevel gear operably engaged with the first bevel gear, such that rotation of the first bevel gear causes rotation of the second bevel gear;

an arbor assembly operably connected to the second bevel gear, the arbor assembly accessible for mounting a saw blade thereto from an accessory side of the housing, and the arbor assembly defining a first axis of rotation;

wherein the first bevel gear is located between the second bevel gear and the accessory side of the housing along the first axis of rotation;

a first roller bearing member at least partially positioned in a bearing recess defined by a housing of the power tool and configured to rotatablv support a bearing end of the arbor assembly opposite from the accessory end along the first axis of rotation;

a thrust bearing member separate from the first roller bearing member and positioned in the bearing recess and against an end surface of the bearing end of the arbor assembly, the thrust bearing member configured to limit axial movement of the arbor assembly along the first axis of rotation;

wherein the first bevel gear defines a second axis of rotation; and

wherein the second axis of rotation intersects the arbor assembly between the second bevel gear and the accessory side of the housing.

2. The saw assembly of claim **1**,

wherein the second bevel gear is positioned between the first roller bearing member and the first bevel gear along the first axis of rotation.

3. The saw assembly of claim **2**, further comprising:

a second roller bearing member supported by the housing and configured to rotatably support the arbor assembly, the second roller bearing member located between the accessory side of the housing and the first bevel gear along the first axis of rotation.

4. The saw assembly of claim **3**, wherein the first bevel gear is located between the second bevel gear and the second roller bearing member along the first axis of rotation.

5. The saw assembly of claim **1**, wherein the first axis of rotation is substantially perpendicular to the second axis of rotation.

6. The saw assembly of claim **1**, wherein the first bevel gear is threadingly engaged with the motor shaft.

7. The saw assembly of claim **1**, wherein the first axis of rotation intersects the second axis of rotation.

8. A power tool, comprising:

a motor;

a first bevel gear operably connected to the motor for rotation;

a second bevel gear operably engaged with the first bevel gear, such that rotation of the first bevel gear causes rotation of the second bevel gear;

an arbor assembly operably connected to the second bevel gear, the arbor assembly defining a first axis of rotation and including an accessory end accessible for mounting an accessory thereto;

a first roller bearing member at least partially positioned in a bearing recess defined by a housing of the power tool and configured to rotatably support a bearing end of the arbor assembly opposite from the accessory end along the first axis of rotation; and

a thrust bearing member separate from the first roller bearing member and positioned in the bearing recess against an end surface of the bearing end of the arbor assembly, the thrust bearing member configured to limit axial movement of the arbor assembly along the first axis of rotation,

wherein the first bevel gear is located between the second bevel gear and the accessory end of the arbor assembly along the first axis of rotation.

9. The power tool of claim **8**,

wherein the second bevel gear is positioned between the first roller bearing member and the first bevel gear along the first axis of rotation.

10. The power tool of claim **9**, further comprising:

a second roller bearing member supported by the housing and configured to rotatably support the arbor assembly, the second roller bearing member located between the accessory end and the first bevel gear along the first axis of rotation.

11. The power tool of claim **10**, wherein the first bevel gear is located between the second bevel gear and the second roller bearing member along the first axis of rotation.

12. The power tool of claim **8**, wherein:

the first bevel gear defines a second axis of rotation; and

the second axis of rotation intersects the arbor assembly between the second bevel gear and the accessory end.

13. The power tool of claim **12**, wherein the first axis of rotation is substantially perpendicular to the second axis of rotation.

14. The power tool of claim **8**, wherein the first bevel gear is threadingly engaged with a motor shaft of the motor.

15. The power tool of claim **8**, wherein the thrust bearing member is positioned completely between the housing and the arbor assembly along the first axis of rotation.

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